INDIAN KNOWLEDGE SYSTEMS

Editors

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Indian Knowledge Systems

(A treasure trove of the way of Holistic and Sustainable Life)

Editors

Sandeep Jadhav

Dr Sandeep Dhikale (Sandeepsagar)

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Humbly Dedicated to

Rev. Pandurang Shastri Athavale (Dadaji) a visionary philosopher, spiritual guide, and social reformer, whose teachings continue to illuminate the path of holistic knowledge, selfless service, and universal brotherhood. His unwavering commitment to reviving and actualizing the essence of Indian wisdom remains a beacon of inspiration.

&

Prof. Ravindra Muley a revered academician and mentor, whose unwavering support and profound insights have deeply influenced our understanding of Indian Knowledge Systems. His dedication to the dissemination and preservation of our intellectual heritage has been truly inspiring.

May their wisdom and blessings continue to guide and inspire seekers of knowledge for generations to come.

Foreword

I feel very happy to write a few words about the Indian Knowledge Systems edited by Sandeep Jadhav and Dr Sandeep Dhikale (Sandeepsager). It is published by 'Devbhasha Foundation' of Pune. Indian Knowledge System has a long age-old tradition originating from the ancient most text. Its flow has meandered through various modes with the traveling time and has enriched the intelligence of the investigators and explorers. In the ultra-modern age of technology, it needs to decode the ancient knowledge which has a bearing upon the advance methods of spread of knowledge which is eternal. The investigation through this treasure with the help of multifarious devices and advancing expanse of the branches of knowledge is the need of the time and this collection caters the same. This book is the step on that path which will lead to the understanding and comprehending the fundamental unanimity and homogeneity among veried disciplines, finally aiming towards one and the same aim, holistic and sustainable life. The scholars that have added to the contents of the book are the striving academicians who have taken the vow of the spread of knowledge to its every aspect. They will certainly achieve their goal and also the aim of their learning and endeavours the contentment of soul.

I wish them every success in their undertaking and congratulate them on this achievement.

– **Prof. Dr. Vinaya Kshirsagar**
Consultant, Project of Digitised Descriptive Catalogue Dharohar,
Udaipur, Rajasthan
&
Ex. Joint General Editor, Encyclopaedic Dictionary of Sanskrit
Rtd. HoD, Sanskrit and Lexicography,
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16 April 2025

It is with immense pleasure that I write this foreword for a volume dedicated to the timeless treasures of *Bharatiya Jñāna Paramparā*—Indian Knowledge Systems. Particularly in our current era, where innovative approaches rooted in indigenous knowledge are paramount for progress, this scholarly undertaking is both essential and deeply significant for the future of learning and societal evolution.

This book transcends a mere compilation of academic papers; it represents a thoughtful and timely contribution to the vital discourse surrounding Indian Knowledge Systems (IKS). Designed as a guiding resource for students and scholars, it weaves together diverse perspectives from philosophy, ancient sciences, art, and culture, united by their intrinsic interconnectedness and the indispensable harmony between inner and outer realities.

My acquaintance with Dr. Dhikale, a devoted Sanskritist and a passionate advocate for Peace Studies, has been enriching. His dedication to integrating India's profound knowledge systems into the framework of global peace education warrants high praise. I commend Dr. Dhikale and his team of young scholars for their diligent and sincere work, a collaborative endeavour marked by scholarly rigour, cultural awareness, and a vision aligned with the noble principles of *vidyā* (knowledge) and *sevā* (service).

Personally, this volume stirs fond recollections of my late father, Prof. Ramji Upadhyaya, a distinguished early recipient of the D. Litt. in Sanskrit and a revered figure who embodied the very spirit of *Bharatiya Jñāna Paramparā* and intellectual tradition. His life, characterized by simplicity, profound scholarship, and spiritual discipline, continues to inspire me, and it is deeply gratifying to find echoes of these values within this book's content.

My sincere congratulations to the entire team. I wholeheartedly commend the effort and dedication behind this publication. May it find a wide readership, serve as a valuable reference, and inspire profound contemplation.

Sincerely,

Professor Priyankar Upadhyaya
UNESCO Chair for Peace, Banaras Hindu University
Distinguished Professor & Senior Advisor
Dr. Vishwanath Karad MIT World Peace University, Pune

संस्कृतपरिषद्

(केन्द्रीयसंस्कृतविश्वविद्यालयेन
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Best Wishes

At the outset I convey my congratulations to this young scholar, Dr. Sandip Ji for this very significant work in the field of Indian Knowledge Systems. This book bears lot of propriety especially when the nation is marching towards a different education system that is centered on the intellectual identity of Bharat. As we all know, Bharat was always rich in terms of culture, wisdom, knowledge, material resources and other.

Just as a ripe paddy filed gets exposed to all kinds of attack from animals and birds, this nation too was exposed to attack from outside and within. The intrusion from foreign lands was so ghastly that it changed the face of Bharat, throwing it from the bright age of scientific excellence into the abysmal darkness of slavery of all kinds. Education system that attracted many interested students from distant lands and produced stalwarts like Panini, Kautalya, Aryabhata, Bhaskaracharya and other was then gradually destroyed. The native technology reflected in temples, monuments and other artefacts was extirpated in such a way that the later generations believed all that to be an imagination or purana. Many centuries reeled under this atrocious act of foreign rulers who barely had any respect for the varied heritage of this land.

Even worse has been the attack from within. The Indians of new generation, who are trained in mimicking but not in any art or science or in any discipline, ignored the monumental achievements of their ancestors and had focused on material gains. Crores of people got educated without a proper education system, got academic degree without a degree of wisdom, got settlement without an iota of respect for their nation. A bright nation thus gradually slipped into slumber on a golden cot. This was not any sound sleep, but certainly a dangerous state of coma.

The Government of India initiated NEP-20 to bring reforms into education system with due emphasis on Indian Knowledge Systems to revive self-respect of Bharat. This initiative will certainly bring changes in many years to come and this important book by Dr. Sandip Ji will serve as a beacon light in that direction.

This book is well designed covering almost all the most important branches of Indian Knowledge Systems. The information has been well gleaned from authentic sources and well presented. I firmly believe that this is the book that the present generation has been looking for.

I wish all the best for the author/s and look forward to receiving many more books of this kind.

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Foreword

The Indian Knowledge System (IKS) is a vast and intricate tapestry of wisdom, encompassing outline and overview of Indian Philosophy, Sciences (14 *vidyās*), Medicine, Arts (64 *kalās*), Mathematics, Astronomy, Architecture, Ayurveda, Governance, and sustainable living practices that have evolved over millennia. It is not merely a historical curiosity but a living, breathing framework that continues to offer insights into the interconnectedness of life, nature, and consciousness.

This book on Indian Knowledge Systems edited by Dr. Sandeep Jadhav and Dr. Sandeep Dhikale (Sandeepsagar) is a humble attempt to explore the profound depth and timeless relevance of IKS. At a time when the world is grappling with ecological crises, mental health challenges, and the search for holistic education models, revisiting the Indian knowledge traditions offers not just answers, but new ways of asking the right questions.

Bridging ancient wisdom with contemporary relevance, this work brings together scholarly research, lived experiences, and indigenous perspectives. It is an invitation to rethink what knowledge means — not as a linear accumulation of facts, but as a dynamic interplay of understanding, values, and context.

I hope this book not only informs but inspires a deeper inquiry into the treasures of India's intellectual heritage and their potential to shape a more harmonious, sustainable future. I sincerely wish the very best for their future endeavours.

D. Mohanty
Prof. Divakar Mohanty

HERITAGE FOUNDATION

(India, USA, Thailand, Bangldesh, Saudi Arab, England, South Korea)

Shubh Sandesh

The Book Indian Knowledge Systems (A treasure trove of the way of Holistic and Sustainable Life) edited by Sandeep Jadhav Dr Sandeep Dhikale (Sandeepsagar) ji is an excellent book which gives a brief and in depth knowledge about what is Bha+Rat? What is knowledge? And What are it's Traditions?

The region where peoples dedicated their life to become enlighten with the true knowledge for the welfare of all (not only the human but the whole universe) so this culture which always pray for 'Vasudhaiv Kutumbakam', pray for 'Sarve Bhavantu Sukhinah' (never says that only Bharatiya bhavantu sukhinah or only Hindu bhavantu sukhinah).

Our Such Vishwakalyan Drushti / Thoughts becomes our action and such action oriented Acharyas/teachers becomes our leaders, the leaders of our life. Acharante iti Acharyah, and our all achryas also dedicated their lives for welfare of all.

Hope this book which is written by such two acharys will become a pathfinder for all.

तप अनवरत चलता रहेगा
तुम भी एक दीपक बनो
बाती बनकर मै जलता रहूंगा
आचार्य का यह जीवन संदेश सुनो

With the lots of best wishes from bottom of heart for this book, we all will become

अत्त: दिप भव

Bhujang Bobade
Director, Heritage Foundation
Member, International Council of Museums
Member, International Council on Archives

Wing Commander Sudhir Ayachit (Retd)
Former Joint Director of Education & Training.
Faculty of Peace Studies, MITWPU Pune.

Forward

The Indian Knowledge System (IKS) is a rich and diverse body of traditional knowledge developed over thousands of years. It covers a wide range of subjects such as philosophy, science, medicine, art and education. In today's fast-changing world, the relevance of IKS is more important than ever.

IKS offers a holistic approach to life, focusing on the balance between mind, body and spirit. This is especially useful in modern times where stress, mental health issues, and fast-paced lifestyles are common. Practices like Yoga and Ayurveda promote natural and preventive healthcare, which the world is increasingly adopting.

In terms of environment and sustainability, IKS teaches us to live in harmony with nature. Traditional practices like organic farming water conservation, and the idea of Vasudhaiva Kutumbakam — the world as one family — offers valuable lessons in sustainable living.

India's ancient achievements in mathematics and science such as the concept of zero, the decimal system, and early astronomy, show that scientific thinking was always part of Indian tradition. These can inspire innovation even today.

The Gurukul system emphasized value-based education, discipline, and holistic development which modern education can benefit from. Indian philosophies such as Vedant, Jainism and Budhism offer ethical guidance and inner peace — values that are crucial in today's world of conflict and competition.

The Indian Knowledge System is not just ancient wisdom — it is a powerful guide for building a sustainable, balanced and value-based future. Reviving and applying it thoughtfully can help us address many of todays global challanges.

The team of Sandeep & Sandeep sagar have captured the very essence of Indian Knowledge System handling diverse chapters with utmost clarity and simplicity. They have dealt with each topic with the vision of reserchers perspective and wider angle so as to benefit wider readership. Especially chapters on Dhanurvidya, Darshan, Mathematics and Arthshastra stand out and very succintly crafted. My heartfelt kudos and appreciation for their outstanding contribution and steller efforts in bringing out this volume for very wider readership.

I sincerely offer my best wishes and God speed in their venture.

I hope many more are in the offing.

शुभशंसनम्।

भारतीयपरम्परायां ज्ञानप्राप्तेः महत्त्वं मूलभूतम् । ज्ञानमेतद् जीवनसमृध्यर्थं भवतु अन्तिमकल्याणार्थं वा भवतु । अत एव 'द्वे विद्ये वेदितव्ये परा च अपरा च' इत्युक्त्वा परा अपरा इत्यनयोः विद्ययोः निर्देशः मुण्डकोपनिषदि कृतोऽस्ति । ऐहिकजीवनविकासार्थं पराविद्यायाः, आत्मानुभवार्थम् अपराविद्यायाः आवश्यकता । अन्तिमं सत्यं, आत्मनः स्वरूपं ज्ञानपदेन निर्दिष्टमिति सत्यं, परं समृद्धजीवनम्, अन्तिमतत्त्वस्य अनुभवः इति मिलित्वैव परिपूर्णं जीवनं भवेत् इति भारतीयपरम्परायाः धारणा । ऐहिकं पारलौकिकं च जीवनं परिपूर्णं भवतु इति चिन्तनम् भारतीय संस्कृतेः विद्यते । प्राचीना, गभीरा, चिन्तनशीला, चैतन्यप्रदा च इयं परम्परा । वेदादारभ्य प्रारब्धं चिन्तनं धारारूपेण प्रचलति एव । नूतनशिक्षानीतौ भारतीयज्ञानपरम्परायाः अन्तर्भावः प्रधानतया कृतोऽस्ति ।

इमं विषयमधिकृत्य इतस्ततः विद्यमानस्य विपुलसाहित्यस्य एकस्मिन्नेव स्थले सङ्कलनं, सम्पादनं च आवश्यकमासीत् । कठिनं तत्कार्यं प्रा. सन्दीपजाधव, डॉ. सन्दीप ढिकले (सन्दीपसागर) इत्यादिभिः प्रारब्धं पूर्णतां च नीतम् । 'सं गच्छध्वं सं वदध्वं सं वो मनांसि जानताम् देवा भागं यथा पूर्वे सञ्जानाना उपासते' इति इमं मन्त्रम् अङ्गीकृत्य सर्वेः ऐकमत्येन सुचारुतया कार्यमेतत् सम्पादितम् अतः सर्वे अभिनन्दनार्हाः इति सानन्दं प्रतिपादयामि ।

ग्रन्थस्यास्य सम्पादकाः , पद्मविभूषण प.पू. पाण्डुरङ्गशास्त्रिणां विचारैः प्रेरिताः प्रभाविताः, अतः विचाराणां अधिष्ठानं तु तैः तत्त्वज्ञानविद्यापीठे एव प्राप्तम् । अतः इमं विषयं प्रतिपादयितुं समर्थाः ते । भारतीयपरम्परायां विद्यमानाः विचाराः व्यापकाः, जीवनस्पर्शिनः परं संक्षेपेण परिपूर्णतया, स्पष्टतया तेषां प्रतिपादनमावश्यकमासीत् तत्कार्यमत्र सञ्जातमिति मन्ये । चतुर्विंशतिविभागेषु प्रतिपादितानां विषयाणां वैशिष्ट्यं नाम भारतीयसंस्कृत्यां

प्रतिपादितानां आधुनिकजीवनसंबद्धानां विषयाणामपि चिन्तनमत्र विद्यते ।

संस्कृतिविकासविषये केषाञ्चन अंशानां चिन्तनं यदि क्रियते तर्हि समकालीनसंस्कृतीनां विचारः अपरिहार्यः, तत्र भारतीया संस्कृतिः सर्वासां संस्कृतीनां मूर्ध्नि वर्तते इति साभिमानं वक्तुं शक्यते । कालानुसारं सातत्येन परिवर्तनशीला परं दृढा च इयं संस्कृतिः अतः चिरनूतना वर्तते । भारतीयसंस्कृतौ विद्यमानाः शारीरिक-मानसिक-बौद्धिक-आध्यात्मिकविकासार्थं नैके बीजभूताः विचाराः स्थलकालातीताः जीवनस्पर्शिनः च विद्यन्ते । तेषां चिन्तनं ग्रन्थेऽस्मिन् प्रतिपादितं अतः ग्रन्थोऽयं सर्वस्पर्शी एव इति वक्तुं शक्यते । अतः डॉ. सन्दीप ढिकले (सन्दीपसागर), सन्दीप जाधव, डॉ. ओङ्कार जोशी, डॉ. प्रतिमा वामन, प्रा. अङ्कित रावल, डॉ. रोशन भगत, डॉ.दयिता रोय, प्रा. अतिश कुलकर्णी, प्रा. मनोज शेगर, प्रा. सचिन पाटील तथा श्रीमती सुवर्णा वडजे इत्येते सर्वे प्रशंसाहाः अभिनन्दनार्हाः ।

कार्यस्यास्य विस्तारः इतोऽपि अधिकः भवतु इति शुभानुशंसनं कृत्वा विरमामि ।

प्रा. डॉ. रविन्द्र मुळे
भूतपूर्वः उपाध्यक्षः
महर्षी सान्दीपनि राष्ट्रीय वेदविद्या प्रतिष्ठान (MSRVVP)
शिक्षा मंत्रालय, भारत सरकार

भूतपूर्वः सञ्चालकः
संस्कृत प्रगत अध्ययन केन्द्रम्,
सावित्रीबाई फुले पुणे विद्यापीठम्, पुणे

Acknowledgement

A special thanks to our Tattwajnan Vidyapeeth, Thane, whose deep-rooted teachings and enriching philosophy offered us a more integrated and holistic understanding of Bharatiya Jnana Parampara. The spiritual grounding and philosophical clarity gained through this institution have been a guiding light in our lives and in the making of this book.

We are also thankful to the academic environments at our respective institutions, which nurtured our thoughts, encouraged our curiosity, and supported our exploration of interdisciplinary approaches rooted in Indigenous wisdom.

We humbly acknowledge that Indian Knowledge Systems are as vast and profound as the ocean — with infinite layers of meaning, depth, and dimensions yet to be discovered. If at any point we have fallen short — in understanding, in interpretation, or in representation — the limitations are entirely ours. We respectfully request our readers, scholars, and elders to kindly let us know of any such oversights, and we assure you that we will make the necessary corrections.

Lastly, we have taken great care to trace and contact all copyright holders for the content used. If any references have been inadvertently included without proper acknowledgement, we extend our sincere apologies and welcome corrections. The editors shall be pleased to make appropriate arrangements at the earliest opportunity.

This volume stands as a collective voice of devotion to Bharatiya Parampara, offered with the spirit of seva and shraddha. May it serve as a small yet meaningful step toward reviving, preserving, and celebrating the holistic and sustainable wisdom of our ancient yet ever-relevant traditions.

With folded hands and grateful hearts,
Sandeep and Sandeepsagar with the team of contributors.

CONTENTS

Introduction

India's civilizational identity has always been deeply anchored in the pursuit of knowledge (vidyā), wisdom (jñāna), and spiritual realization (mokṣa). Through centuries of philosophical inquiry, scientific exploration, artistic expression, and socio-cultural evolution, Bharat has nurtured a vibrant and holistic tradition of knowledge, collectively referred to as the 'Bharatiya Jñāna Paramparā' or 'Indian Knowledge Systems' (IKS). In the contemporary global landscape, where technological advancement often outpaces ethical reflection, revisiting and revitalizing these indigenous traditions is not merely a cultural act—it is a civilizational imperative.

Indian Knowledge Systems encompass a vast and intricate web of intellectual disciplines and practical wisdom that originated, evolved, and flourished on the Indian subcontinent. These include (but are not limited to), Ayurveda, Yoga, Sanskrit-Prakrit-Tamil literature, Vedic sciences, classical music and arts, astronomy, mathematics, polity (rājadharma), architecture (vāstuśāstra), logic (nyāya), and ethics etc.. Each of these domains is not isolated but interconnected, reflecting a seamless integration of theory and practice, of the metaphysical and the material, of the individual and the

universal.

India, the cradle of civilization, has been a beacon of wisdom, philosophy, and innovation for millennia. The profound legacy of its Jñāna Paramparā—the Indian Knowledge Systems (IKS)—represents a holistic worldview that seamlessly integrates intellectual, spiritual, and empirical dimensions of life. In a world facing multidimensional crises—ecological, ethical, mental, and cultural—the study and application of IKS becomes not just relevant but essential.

Indian Knowledge Systems are not confined to ancient scriptures or isolated practices of the past. Rather, they embody a timeless repository of knowledge that has evolved through continuous inquiry, reflection, and dialogue across generations. Encompassing domains such as philosophy (darśana), literature, medicine (Āyurveda), mathematics, astronomy, and sustainable living, IKS provides a comprehensive framework to understand reality and live in harmony with oneself, society, and nature.

One of the foremost contributions of IKS is its role in shaping Bhāratiya Drishti—a uniquely Indian worldview that sees life not as a fragmented pursuit, but as an interconnected whole. This vision fosters harmony between the internal and external, between science and spirituality, and between human aspirations and cosmic rhythms. By revisiting this wisdom in today's context, we not only reaffirm our civilizational identity but also discover viable pathways to navigate the complexities of the 21st century.

IKS offers pragmatic approaches to contemporary global challenges, be it climate change, public health crises, mental well-being, social alienation, or the erosion of ethical values. For instance, Ayurveda and Yoga

promote preventive healthcare and holistic wellness; Vedic and Jain cosmologies highlight ecological sensitivity and non-violence; Indian mathematics, with its revolutionary concept of zero, redefined global scientific progress; and philosophical traditions such as Vedānta and Sāṃkhya provide deep insights into consciousness and the nature of self.

The 'Vasudhaiva Kuṭumbakam' philosophy—proclaiming the world as one family—is a clarion call for global cooperation, mutual respect, and sustainable coexistence. These timeless values find resonance in India's cultural narrative and offer a moral compass for a fractured world.

Equally important is the relevance of IKS to the pressing needs of the present world. With global challenges becoming increasingly urgent, the holistic principles embedded in Indian traditions offer sustainable and ethical alternatives. The age-old reverence for nature, embedded in practices and philosophies across the scriptures and treatises, provides a time-tested framework for environmental stewardship and responsible living.

Moreover, the Indian Knowledge Systems nurture a spirit of inquiry and innovation. Fields such as Tarkaśāstra, Vyākaraṇa, and Śilpaśāstra reflect a sophisticated methodology of logic, language analysis, and design thinking that foster both critical and creative faculties. These disciplines exemplify the Indian tradition of knowledge not as dogma, but as an ever-evolving dialogue between experience, reason, and transcendence.

In the age of globalization and technological acceleration, the study of IKS also serves to restore intellectual tradition. It empowers the Indian academic ecosystem to decolonize knowledge by offering an indigenous framework that is globally relevant. Through this, students and scholars can

develop a confident and rooted identity while participating meaningfully in global discourses on science, ethics, and policy.

The Role of IKS in the 21st Century: Relevance and Revival

In alignment with this vision of 'Vasudhaiva Kuṭumbakam', the National Education Policy 2020 (NEP 2020) marks a paradigm shift by acknowledging the value of IKS and its rightful place in Indian academia. It recommends embedding IKS into school and university curricula, promoting research in indigenous disciplines, and training teachers in traditional knowledge systems. Complementing this vision, the Indian Knowledge Systems Division under the Ministry of Education is actively facilitating collaborative initiatives, resource development, and scholarly engagement with IKS.

In the post-pandemic world, as nations look inward for cultural and intellectual sustenance, India's civilizational wisdom emerges as a wellspring of solutions. From the grassroots movements rooted in grama-swarāj to the universal teachings of 'Vasudhaiva Kuṭumbakam', India has demonstrated that the path to the future runs through/with the past.

What Can We Gain from Indian Knowledge Systems?

Engaging with Indian Knowledge Systems offers profound intellectual and personal enrichment. At its core, IKS provides a coherent framework for ethical living. Concepts like Dharma, Sevā, and Śreyas guide individuals towards righteous conduct, selfless service, and the pursuit of higher good. These principles foster not only personal integrity but also a sense of collective responsibility, thereby contributing to the moral fabric of society.

Indian traditions also offer powerful tools for mental and emotional resilience. Practices rooted in Yoga, Dhyāna, and Vedānta enable individuals

to develop inner stability and self-awareness amidst the chaos of modern life. The teachings of the BhagavadGītā, for instance, serve as a timeless guide for navigating dilemmas, managing stress, and maintaining equilibrium in thought and action.

Incorporating IKS into our lives and institutions enhances cultural literacy and instils global confidence. The understanding of classical texts, aesthetic theories, and philosophical discourses nurtures a refined sensibility and allows individuals to engage with the world from a position of informed authenticity. This cultural rootedness is not restrictive but expansive—it fosters mutual respect, dialogue, and collaboration on a global scale.

Further, Indian Knowledge Systems enrich our understanding of science and innovation through alternate models of inquiry and problem-solving. Ancient Indian contributions in mathematics, astronomy, linguistics, and metallurgy continue to inspire researchers and innovators. These systems do not oppose modern science but rather offer complementary perspectives grounded in ethical and ecological awareness.

IKS encourages a shift in how we define progress and success. It places emphasis on Ānanda (inner joy), Santulan (balance), and Sādhanā (dedicated effort) over mere accumulation. This shift aligns closely with contemporary global aspirations for sustainable development, well-being, and peace. In this light, Indian Knowledge Systems are not remnants of the past but blueprints for a wiser and more harmonious future.

This book seeks to contribute to this national mission by exploring the depth, diversity, and contemporary relevance of IKS. It aspires to help

students, educators, and researchers to recognize, preserve, and rejuvenate India's indigenous knowledge traditions and to integrate them meaningfully with modern scientific paradigms.

In doing so, we are reaffirming our understanding that the timeless truth that knowledge is not merely for accumulation but for transformation— of the self, the society, and the world at large.

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1.

Bharat (Bha+Rat)

(Bharat: A Living Concept Beyond Borders)

Bharat is not merely a geographical or political territory marked on modern maps; it is an eternal civilizational idea that dwells in the hearts and minds of its people. It is a civilisational identity—timeless, sacred, and deeply philosophical. Etymologically, The very name 'Bharat' carries within it a deeper philosophical significance. It is derived from '**Bha**' meaning light or knowledge, and '**Rata**' meaning engrossed, immersed or deeply engaged.

'Bha' denotes light—not just in the physical sense, but the **light of knowledge (vidyā)**, **light of power (śakti)**, **light of prosperity (śrī)**, and **light of inner awakening (caitanya)**. It is the radiance that dispels darkness, both external and internal. Where people are deeply engaged in this 'Bha' is 'Bharat'. Thus, Bharat symbolises a land whose people are devoted to the pursuit of **light, wisdom, and inner awakening**. Bharat is that sacred land where people are immersed in the pursuit of light—be it knowledge, power, prosperity, or spiritual enlightenment. It is a living culture that reveres wisdom, celebrates harmony, and aspires toward higher consciousness.

This understanding forms the bedrock of Indian Knowledge Systems,

which are not confined to texts or traditions alone, but are woven into the lived experiences, values, and worldview of its people across centuries.

This fundamental idea of Bharat forms the essence of the Indian Knowledge Systems (IKS), where knowledge is not merely acquired but lived, transmitted, and experienced as a means to attain holistic well-being and universal peace.

From Bharat to Sindhusthan to India: A Civilisational Journey of Names

While Bharat represents the spiritual and philosophical identity of this ancient land, the evolution of its other names reflects its geographical expanse, historical exchanges, and cultural transformations over time. One such prominent name is **Sindhusthan**, derived from the **Sapta Sindhus**—the seven sacred rivers mentioned in the Rigveda, with the River **Sindhu** (present-day Indus) being the most significant among them. These rivers not only nourished the land physically but also sustained the flow of Vedic knowledge and civilisation. Hence, the land around and beyond the River Sindhu came to be referred to as Sindhusthan—the land of the Sindhu.

As history unfolded and interactions with other cultures and languages intensified, this term underwent phonetic shifts. The ancient Persians, who found it difficult to pronounce the Sanskrit 'Sa' sound, substituted it with 'Ha'. Thus, Sindhu became Hindu, and Sindhusthan became Hindusthan—the land of the Hindus. Here, 'Hindu' referred not to a religion in its modern sense but to a geographical and cultural identity rooted in the land east of the Sindhu River.

Over time, with the arrival of the Greeks and later Western colonisers, further transformations occurred. The Greeks referred to the land as Indos,

and the Romans as India. Thus, Sindhu became Hindu, then Indu, and finally India—the name by which Bharat came to be known in the modern global context.

Some oral traditions also mention variations like Sindhiya to Hindiya to India, showing how geographical references evolved into nomenclatures accepted by foreign powers, often detached from the deeper Indic identity of Bharat.

Despite these historical transformations in name, the essence of the land—its values, wisdom traditions, and cultural ethos—has remained rooted in its original identity as Bharat. A name that reflects not only a territory but a timeless ideal of living in the light of truth, knowledge, and inner awakening.

The Four Bharatas: Embodiments of a Civilisational Ideal

The sacred land of Bharat is not only known by its name but also by the luminous lives of great personalities who embodied its spirit and left a lasting imprint on its identity. Across various epochs and traditions—Vedic, Itihāsa, Purāṇic, and other philosophical traditions, the name Bharata has been borne by illustrious figures whose lives exemplified the very essence of light, dharma, and self-realisation. Among them, four such Bharatas stand out prominently, whose legacy continues to inspire the civilisational consciousness of this land.

1. **Chakravarti Bharata (Sarvadamana)** – The Emblem of Sovereign Dharma The son of Maharaja Dushyanta and Devi Shakuntala, Bharata earned the title Bharata for having conquered not just territories but the hearts of people through just rule and noble character. As the

forefather of the Kauravas and Pandavas, his name became synonymous with Bharatavarsha, the vast land under his righteous rule. He represents the ideal of sovereign leadership rooted in dharma, discipline, and responsibility.

2. **Prince Bharata – Brother of Lord Rama** – The Embodiment of Sacrifice and Fraternal Devotion In the epic Rāmāyaṇa, Bharata, the younger brother of Lord Rāma, stands as a timeless symbol of selflessness and loyalty. Though offered the throne of Ayodhya, he renounced it, placing SriRāma's pādukās (footwares) on the throne and ruling as a devoted caretaker in his absence. His life is a shining example of tyāga (sacrifice), niṣkāma karma (selfless action), and unwavering adherence to righteousness.

3. **Jada Bharata – The Realised Sage in Disguise** Born as a king and later living the life of an avadhūta, Jada Bharata is a powerful representation of the inward journey in Indian thought. Though appearing dull and inert to the world, he was a fully realised ātma-jñānī who saw beyond the illusion of worldly life. His spiritual knowledge unveils the depth of Vedantic wisdom and the power of vairāgya (detachment) and inner illumination.

4. **Chakravarti Bharata (Jain Tradition)** – The Universal Monarch and Seeker of Liberation In Jain tradition, Bharata is the eldest son of Ṛṣabhanātha, the first Tīrthaṅkara, and the first Chakravartin (universal monarch). Though he ruled over a vast empire, he eventually realised the transient nature of worldly power and renounced it in pursuit of spiritual liberation. His story beautifully bridges the Jain ideals of righteous rule (rājyadharma) and

renunciation (mokṣamārga), further enriching the composite spiritual heritage of Bharat.

These four illustrious Bharatas, hailing from diverse traditions yet united in their embodiment of light, virtue, and transcendence, reveal the true essence of the name Bharat. It is not merely a name, but a living legacy—reflecting the eternal ideals of dharma, wisdom, and inner awakening that define this sacred land.

Why Study Indian Knowledge Systems (IKS)?

The Indian Knowledge Systems (IKS) represent one of the world's most ancient and continuous traditions of holistic wisdom. Rooted in the civilisational ethos of Bharat, IKS is not merely a body of knowledge but a way of life—deeply integrated with the pursuit of harmony between the self, society, nature, and the cosmos.

The study of IKS is important for several profound reasons:

1. **Civilisational Continuity and Identity**: Understanding IKS fosters a deeper connection with our heritage. It nurtures a sense of pride in our civilisational journey, which has sustained scientific thought, spiritual inquiry, philosophical refinement, artistic excellence, and social harmony for millennia. It reconnects modern Indians with the intellectual and cultural wealth of their ancestors.

2. **Holistic Worldview**: Unlike fragmented approaches, IKS offers an integrated vision of life where science, ethics, metaphysics, health, and art coexist. Disciplines like Āyurveda, Yoga, Nāṭyaśāstra, Vastu,

Arthashastra, and Vedānta are examples of knowledge systems that harmonise material progress with spiritual growth.

3. **Indigenous Solutions to Contemporary Challenges**: In an age of ecological crises, mental health issues, and social unrest, IKS provides time-tested models rooted in sustainability (prajñā), inner well-being (antarśānti), and inclusive social structures (dharma-samāja). It presents indigenous frameworks that are relevant and adaptable to modern needs.

4. **Decolonisation of Knowledge**: Studying IKS helps overcome the epistemological dominance of colonial and Eurocentric narratives. It enables the reassertion of Indian categories of thought and methods of knowing (pramāṇa), offering alternate paradigms in science, education, governance, and philosophy.

5. **Global Relevance with Indian Roots**: As the world increasingly looks toward India for spiritual wisdom, wellness sciences, and ethical leadership, the study of IKS empowers individuals to articulate and share these treasures with authenticity, scholarship, and pride.

Thus, to study Indian Knowledge Systems is not only an academic exercise—it is a journey of rediscovering who we are, reclaiming our intellectual sovereignty, and contributing meaningfully to a more balanced and enlightened global future.

Indian Knowledge Systems: The Path from Knowledge to Wisdom

1. **IKS is the study of knowledge to attain wisdom**: It goes beyond the

accumulation of information—it is the pursuit of jñāna that transforms into vijñāna and ultimately leads to prājña (wisdom). IKS nurtures intellectual clarity, ethical grounding, and spiritual insight, guiding individuals toward a holistic understanding of life.

2. **IKS is the study to foster sustainable development**: Rooted in harmony with nature, society, and the cosmos, IKS presents frameworks of sustainability that are ecological, economic, and spiritual. Whether through Vāstuśāstra, Āyurveda, or Arthashāstra, it promotes living in balance—with oneself and with the environment.

3. **IKS is the study of the past to shape the future:** It draws from the timeless wisdom of our ancient traditions not to remain in the past, but to illuminate the path ahead. IKS empowers future generations by offering values, vision, and tools grounded in experience, resilience, and relevance.

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Fourteen Vidyās and Sixty-Four Kalās

The **14 Vidyās** form the **intellectual and philosophical foundation** of ancient Indian thought, while the **64 Kalās** represent the **practical and aesthetic refinement** of an individual. Together, they reflect the holistic vision of **Bharatiya Jñāna Paramparā (भारतीय ज्ञान परंपरा)**, where knowledge and art blend to create a balanced, cultured, and enlightened society.

The **64 Kalās** are considered the refined skills or accomplishments that an individual—especially in classical Indian education—was expected to master for a cultured and complete personality. These are often associated with the education.

14 Vidyas (techniques)

4 Vedas

1. RigVeda
2. SamVeda
3. YajurVeda
4. AtharvaVeda

4 UpaVedas (abodes of knowledge)

1. ArthaShastra: Ancient treatise on statecraft, economic policy and military strategy.
2. Dhanurveda: Science of archery
3. GandharvaVeda: Treatise on performing arts, encompassing theatre, dance and music.
4. Ayurveda: The word ayurveda consists of the words Ayus, meaning 'longevity', and Veda, meaning 'related to knowledge' or 'science'. Thus Ayurveda is the science of life.

6 Vedangas

1. Shiksha: science of phonetics and phonology of Sanskrit, its aim is the teaching of correct pronunciation of the Vedic hymns and mantras.
2. Kalpa: art of rituals
3. Vyakaran: Sanskrit grammatical tradition of vyakarana.
4. Nirukta: art of etymology, particularly of obscure words. It consists of brief rules (sutras) for deriving word meanings, supplemented with glossaries of difficult or rare Vedic words.
5. Chhanda: study of Vedic meter in Classical Sanskrit poetry.
6. Jyotish: system of astrology

Chausath Kalas (64 forms of art)

The Indian literary tradition contains an extensive discussion on various arts, and their numbers are specified differently in various texts. Apart from the ancient scriptures like the Ramayana and the Mahabharata, numerous Puranas and poetic works also describe a variety of arts. Not only scriptural knowledge but also worldly knowledge useful for day-to-day life was considered important. Among such practical knowledge, education in arts held a significant place. Dandin, in his Kavyadarsha, has mentioned that

arts like dance and music are associated with kama (desire) and artha (wealth) — (nṛtyagītaprabhṛtayaḥ kalāḥ kāmārthasaṁśrayāḥ). The Kamasutra enumerates 64 arts. Additionally, Jain texts such as Prabandha Kosha and Shukraniti Sara also mention the number of arts as 64. In Lalitavistara, as many as 86 arts are listed. The Shaiva Tantras too make mention of 64 arts. In the Lalita Sahasranama, the Goddess is described as the very embodiment of these 64 arts. Vatsyayana, in his Kamasutra, has presented a list of these 64 arts. Interestingly, the names of all these arts are also found in the thirtieth chapter of the Yajurveda. This chapter comprises a total of 22 mantras, from the fourth to the twenty-second, all of which refer to these very arts and the artists who practice them.

64 forms of Arts as mentioned by Vatsyayana:

1. **Gītam :** The art of singing.
2. **Vādyam :** The art of playing on musical instruments.
3. **Nṛtyaṃ :** The art of dancing.
4. **Natya:** The art of theatricals.
5. **Ālekhyam:** The art of painting.
6. **Viśeṣakacchedyam :** The art of painting the face and body with colour
7. **Taṇḍulakusumavali Vikārāḥ :** The art of preparing offerings from rice and flowers.
8. **Puṣpāstaraṇam :** The art of making a covering of flowers for a bed.
9. **Daśanavasanāgarāgaḥ :** The art of applying preparations for cleansing the teeth, and cloths and painting the body.
10. **Maṇibhūmikākarma :** The art of making the groundwork of jewels.
11. **Śayanaracanam :** The art of covering the bed.
12. **Udakavādyam:** The art of playing music in water.
13. **Udakāghātaḥ :** The art of splashing with water.
14. **Citrāśca Yogāḥ :** The art of practically applying an admixture of colours.
15. **Mālyagrathana Vikalpāḥ :** The art of designing a preparation

of wreaths.

16. **Śekharakāpīḍayojanam :** The art of practically setting the turban on the head.

17. **Nepathyaprayogāḥ :** The art of practically dressing in the tiring room.

18. **Karṇapattra Bhaṅgāḥ :** The art of decorating the tragus of the ear.

19. **Gandhayuktiḥ :** The art of practical application of aromatics.

20. **Bhūṣaṇayojanaṃ :** The art of applying or setting ornaments.

21. **Aindrajālāḥ :** The art of juggling.

22. **Kaucumārā :** a kind of art. An art which gives success in many affairs which cannot be performed by usual means.

23. **Hastalāghavam :** The art of sleight of hand.

24. **Vicitraśākayūṣabhakṣyavikārakriyā :** The art of preparing varieties of delicious food.

25. **Pānakarasarāgāsavayojanam :** The art of practically preparing palatable drinks and tinging draughts with red color.

26. **Sūcīvānakarmāṇi :** The art of needleworks and weaving.

27. **Sūtrakrīḍā :** The art of playing with thread.

28. **Vīṇāḍamarukavādyāni :** The art of playing on lute and small drum.

29. **Prahelikā :** The art of making and solving riddles.

30. **Durvācakayogāḥ :** The art of practising language difficult to be answered by others.

31. **Pustakavācanam :** The art of reciting books.

32. **Nāṭakākhyāyikādarśanam :** The art of enacting short plays and anecdotes.

33. **Kāvyasamasyāpūraṇam :** The art of solving enigmatic verses.

34. **Paṭṭikāvānavetravikalpāḥ :** The art of designing preparation of shield, cane and arrows.

35. **Takṣakarmāṇi :** The art of spinning by spindle.

36. **Takṣaṇam :** The art of carpentry.

37. **Vāstuvidyā :** The art of engineering.

38. **Rūpya- ratna-parīkṣā :** The art of testing silver and jewels.

39. **Dhātuvādaḥ:** The art of metallurgy.

40. **Maṇirāgākarajñānam :** The art of tinging jewels.

41. **Akara jnana:** The art of mineralogy.

42. **Vṛkṣāyurvedayogāḥ :** The art of practicing medicine or medical treatment, by herbs.

43. **Meṣakukkuṭalāvakayuddhavidhiḥ :** The art of knowing the mode of fighting of lambs, cocks and birds.

44. **Śukasārikāpralāpanam :** the art of maintaining or knowing conversation between male and female cockatoos.

45. **Utsādane Saṃvāhane Keśamardane Ca Kauśalam :** The art of healing or cleaning a person with perfumes.

46. **Kesa-marjana-kausala:** The art of combing hair.

47. **Akṣaramuṣṭikākathanam :** The art of talking with fingers.

48. **Dhāraṇamātṛkā :** art of the use of amulets.

49. **Deśabhāṣāvijñānam :** The art of knowing provincial dialects.

50. **Nimittajñānam :** The art of knowing prediction by the heavenly voice.

51. **Yantramātṛkā :** The art of mechanics.

52. **Mlecchitavikalpāḥ :** The art of fabricating barbarous or foreign sophistry.

53. **Samvācyam / Sampāṭhyam:** The art of conversation.

54. **Mānasī Kāvyakriyā :** The art of composing verse

55. **Kriyāvikalpaḥ :** The art of designing a literary work or a medical remedy.

56. **Chalitakayogāḥ :** The art of practising as a builder of shrines called after him.

57. **Abhidhānakośaḥ Chandojñānam :** The art of the use of lexicography and meters.

58. **Vastragopanāni :** The art of concealment of cloths.

59. **Dyūtaviśeṣaḥ :** The art of knowing specific gambling.

60. **Ākarṣakrīḍā :** The art of playing with dice or magnets.

61. **Bālakrīḍanakāni :** The art of using children's toys.

62. **Vainayikīnāṃ Vidyānāṃ Jñānam :** The art of enforcing discipline.

63. **Vaijayikīnāṃ Vidyānāṃ Jñānam :** The art of gaining victory.

64. **Vaitaliki vidya / Vyāyāmikīnāṃ:** The art of awakening master with music at dawn.

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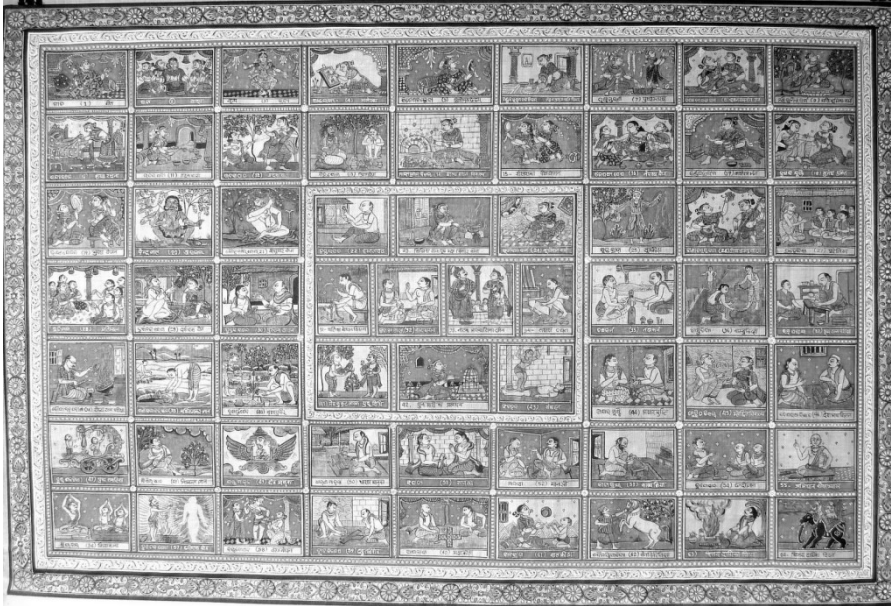
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3.

Darshan: Outline and overview of Indian Philosophical Schools

The Sanskrit term **Darśana (दर्शन)** literally means **'sight', 'vision', 'viewpoint,' or 'philosophical system'.** It is derived from the root √dṛś (to see).

In Philosophical Context:

Darśana refers to a **systematic worldview or philosophical perspective** that seeks to understand the nature of reality, self, and the universe. It implies **'seeing' or 'realizing' the truth** through inner insight, reason, and scriptural wisdom.

Each Darśana presents a distinct vision or **interpretation of the ultimate truth** and offers a method for attaining liberation (**mokṣa**). In the Indian tradition, philosophy is not just speculative but **experiential and transformative**.

Broader Meaning:

In a more general cultural or devotional context, **darśana** also refers to **beholding a deity, saint, or sacred object**, especially in temples or holy

places. It signifies a **sacred encounter** with the divine.

Darśana is both a **philosophical system** and an **insightful vision of truth**—a way of seeing that leads to knowing, and ultimately, to liberation.

Here is an outline and overview of the Indian philosophical systems, traditionally known as **Darśanas**:

Outline: Indian Philosophical Schools (Darśanas)

I. Classification of Darśanas

1. **Āstika (Orthodox) Schools** – Accept the authority of the Vedas:
   - Nyāya
   - Vaiśeṣika
   - Sāṅkhya
   - Yoga
   - Pūrvamīmāṁsā (Mīmāṁsā)
   - Vedānta (Uttaramīmāṁsā)
2. **Nāstika (Heterodox) Schools** – Reject the authority of the Vedas:
   - Cārvāka
   - Bauddha (Buddhism)
   - Jaina (Jainism)

Overview of the Major Philosophical Schools

A. Āstika Darśanas (Vaidika Darśanas)

1. **Nyāya** – School of Logic
   - Founder: Gautama (Akṣapāda)
   - Emphasizes **logical reasoning**, **pramāṇa (means of knowledge)**, and **epistemology**.
   - Four pramāṇas: perception, inference, comparison, and verbal testimony.
2. **Vaiśeṣika** – Atomistic and Metaphysical School
   - Founder: Kaṇāda

- Focuses on **categories of reality (padārtha)** such as substance, quality, action.
- Believes in atomic theory and plurality of souls.

3. **Sāṅkhya** – Dualistic Metaphysical School
    - Founder: Kapila
    - Two ultimate realities: **Puruṣa (consciousness)** and **Prakṛti (matter)**.
    - Liberation through discrimination between Puruṣa and Prakṛti.

4. **Yoga** – Practical Discipline for Liberation
    - Founder: Patañjali (Yoga Sūtras)
    - Builds on Sāṅkhya, but includes **Iśvara (God)**.
    - Eight limbs of Yoga (Aṣṭāṅga Yoga): ethical practices, postures, breath control, etc.

5. **Mīmāṁsā (Pūrvamīmāṁsā)** – Ritualistic and Hermeneutic School
    - Founder: Jaimini
    - Focus on **Vedic rituals (karma-kāṇḍa)** and dharma.
    - Stresses the **eternality and infallibility of the Vedas**.

6. **Vedānta (Uttaramīmāṁsā)** – Philosophical Interpretation of the Upaniṣads
    - Founders: Bādarāyaṇa (Brahmasūtras); interpreted by Śaṅkara, Rāmānuja, Madhva, etc.
    - Discusses **Brahman, Ātman, Mokṣa**, and various metaphysical doctrines.
    - Major schools:
        - **Advaita (Non-dualism)** – Śaṅkara
        - **Viśiṣṭādvaita (Qualified Non-dualism)** – Rāmānuja
        - **Dvaita (Dualism)** – Madhva

B. Nāstika Darśanas
1. **Cārvāka** – Materialism

- Belief only in **direct perception** as valid knowledge.
- Rejects afterlife, soul, and karma.

2. **Bauddha (Buddhism)** – Path of the Middle Way
    - Founder: Gautama Buddha
    - Four Noble Truths, Eightfold Path, and doctrines of **Anātman** and **Śūnyatā**.
    - Schools: Theravāda, Mahāyāna, Vajrayāna.

3. **Jaina (Jainism)** – Ethics and Anekāntavāda
    - Founder: Mahāvīra (last Tīrthaṅkara)
    - Emphasizes **Ahimsa**, **Anekāntavāda (multiplicity of truths)**, and **Karma doctrine**.
    - Schools: Shwetambar, Digambar.

Indian philosophy is a rich and diverse tradition rooted in metaphysics, epistemology, ethics, and spirituality. While the **Āstika** schools are aligned with the Vedas, the **Nāstika** schools present alternative approaches. Together, they offer a comprehensive view of **life, liberation, and knowledge**, forming the foundation of Indian intellectual and spiritual heritage.

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4.

Timeless Wisdom: Unveiling the Treasures

(Unveiling the Treasures of Veda, Upaniṣad, Itihāsa, Purāṇa,
Nītiśāstra, and Subhāṣita)

The Indian Knowledge Systems (IKS) are a magnificent confluence of spiritual insight, practical wisdom, and cultural refinement. Spanning millennia, these systems are rooted in a holistic understanding of existence and are designed to foster both inner awakening and outer harmony. Among the most revered and influential textual traditions within this corpus are the **Vedas**, **Upaniṣads**, **Itihāsa**, **Purāṇa**, **Nītiśāstra**, and **Subhāṣita**—each contributing uniquely to the shaping of Bhāratīya Jñāna Paramparā.

The **Vedas**, regarded as śruti (that which is heard), are the foundational scriptures of Indian civilization. Composed in sublime Sanskrit, the four Vedas—Ṛgveda, Yajurveda, Sāmaveda, and Atharvaveda—encompass hymns, rituals, cosmology, and philosophical reflections. They present a vision of life that harmonizes the individual with the cosmos through the pursuit of ṛta (cosmic order) and dharma (righteous duty). The **Upaniṣads**, the philosophical culmination of the Vedas, delve into the eternal questions of self, consciousness, and ultimate reality (Brahman). Through subtle dialogues and profound metaphors, they guide the seeker towards inner realization and spiritual liberation (mokṣa).

The vast corpus of Indian Knowledge Systems (IKS) is not limited to metaphysics and ritual sciences alone; it encompasses a holistic vision of life, society, and governance. Among its many literary genres, the Itihāsa, Purāṇa, Nītiśāstra, and Subhāṣita stand out as timeless repositories of ethical, philosophical, and pragmatic wisdom. These texts, though composed in ancient times, continue to offer profound guidance relevant to contemporary human challenges.

Itihāsa, which includes the Rāmāyaṇa and Mahābhārata, is not merely a chronicle of historical events. Rather, it represents the dynamic interplay of dharma, artha, kāma, and mokṣa through the lives of iconic characters and intricate narratives. These epics provide models of ideal conduct, moral dilemmas, leadership qualities, and spiritual evolution, thus serving as ethical compasses for generations.

The **Purāṇas**, with their encyclopaedic structure, cover a wide range of themes—from cosmology, genealogy, and philosophy to rituals and legends. Their symbolic storytelling and allegorical expressions nurture cultural identity and collective memory. By blending devotion (bhakti) with philosophical reflections (jñāna), the Purāṇas promote an integrated worldview, encouraging both introspection and social engagement.

Nītiśāstra, or treatises on ethics and polity, such as the Hitopadeśa, Pañcatantra, and the works of Cāṇakya, offer practical insights into human behaviour, statecraft, diplomacy, and personal conduct. Their lucid narratives, often illustrated through fables and aphorisms, enable learners to internalize complex values in an accessible form. These texts emphasize prudence, foresight, justice, and resilience—virtues critical for both individual and societal well-being.

Subhāṣitas, literally 'well-spoken sayings,' form another valuable genre in Sanskrit literature. These pithy and profound verses distil centuries of wisdom into memorable couplets that touch upon morality, duty, friendship, learning, and the transient nature of life. They reflect the civilizational ethos of India where refined thought, aesthetic beauty, and

ethical instruction converge.

Together, these streams reflect the genius of Bhāratīya Jñāna Paramparā—where knowledge is not merely theoretical but is designed to elevate both the individual and the collective consciousness. Reintroducing these treasures into contemporary education and discourse can inspire a culturally rooted yet universally relevant worldview, reinforcing India's commitment to peace, harmony, and sustainable development.

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5.

The Wonders of Ancient Indian Maths

History of Counting around the world

It has been a long quest for humans to find out different methods to count things and measure them in their own unique ways of measurement. Numbers are used to put an idea into symbols, and we call them as numerals. We use letters to express sound as symbols. sounds created by the combinatorics of tongue, palate, teeth and throat. But sounds are limited so few symbols are enough for them whereas numbers are unending, so we need more symbols for numbers. Numbers should serve 3 purposes:

1) Proper Symbols for a number

2) Names to those numbers and their combinations and

3) arithmetic operations.

Many civilizations around the world try to solve this problem according to the resources available around them. Some of them are mentioned here:

1. Egyptians

They used standing lines for numbers till ten like **|** for 1 and **| | | |** for 4. For 10, 100, 1000, 10000 and 1000000 they had other symbols. Their base of counting was 10.

2. Americas (Mayan 1500 BCE)

They used dots (•) to mark numbers instead of standing line. 1 to 4 they used dots (••••) and horizontal line (__) for 5 and next combinations will be based on dots above lines like **•••** is equal to 8. Base was 20.

3. Europe (Minoan Civilisation 2700 BCE)

1 to 9 standing lines, then sleeping line for 10 and its multiples. A circle was used to represent 100 and its multiples and plus symbol for 1000 and its multiples by joining the ending point of the lines vertically and horizontally.

4. Sumerian Civilisation (Excluding India 4500 BCE)

Same symbol for all numbers till 59. Symbol is triangle with standing line below its angle point. And then whole construct is built. Base was 60.

Ishango Bone (18000 BCE): Ishango Bone is the earliest known mathematical records found around the world found in Congo, now kept in Royal Belgian Institute of Natural Sciences.

Source: https://en.wikipedia.org/wiki/Ishango_bone

Shulbasutras: Geometry

Shulb: A rope; **Sutras**: Short formulae

Shulbsutras are the earliest known ancient treatises on Geometry

intertwined in Shrautsutras which are part of Yajurveda.
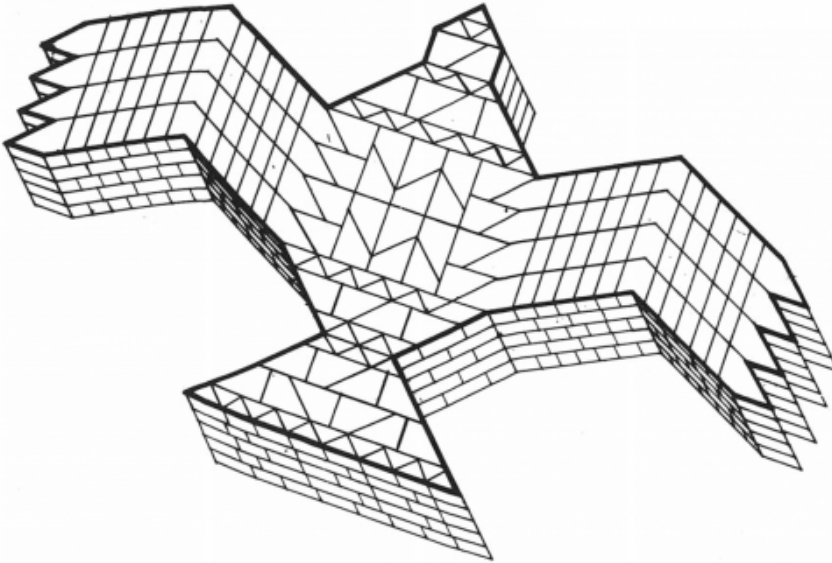
Vedic mathematics, with its vast array of techniques, concepts, and principles, has intrigued mathematicians for centuries. Here we will overview Shulbasutras, the contributions to the value of Pi, the magic squares, circular geometry, and the application of mathematics in astronomy and architecture.

Shulbsutras form an essential part of the Vedic literature and are primarily concerned with the construction of altars for sacrificial rites, as prescribed in the Vedas. These texts are not just limited to religious rituals; they contain profound geometric principles that were applied to the design and construction of sacred spaces, rituals, and altars, known as *yajnas*.

We can see vast range of geometrical operations in Shulbsutras. Construction of a square, circle, triangle, semicircle, rectangles and their transformation in one another. Here we will study some of them.

EAST

ĀHAVANĪYA
Offertorial Fire

Brahmin's[3] Seat

HOTṚ[1]

Patron's Seat

NORTH

VEDI
Altar

SOUTH

ADHVARYU[2]

DAKṢIṆĀGNI
Southern Fire

GĀRHAPATYA
(Householder's
Fire)

Patron's Wife's Seat

[1]Recites Ṛgveda
[2]Recites Yajurveda
[3]Supervises ceremony,
recites Atharvavedaḥ

WEST
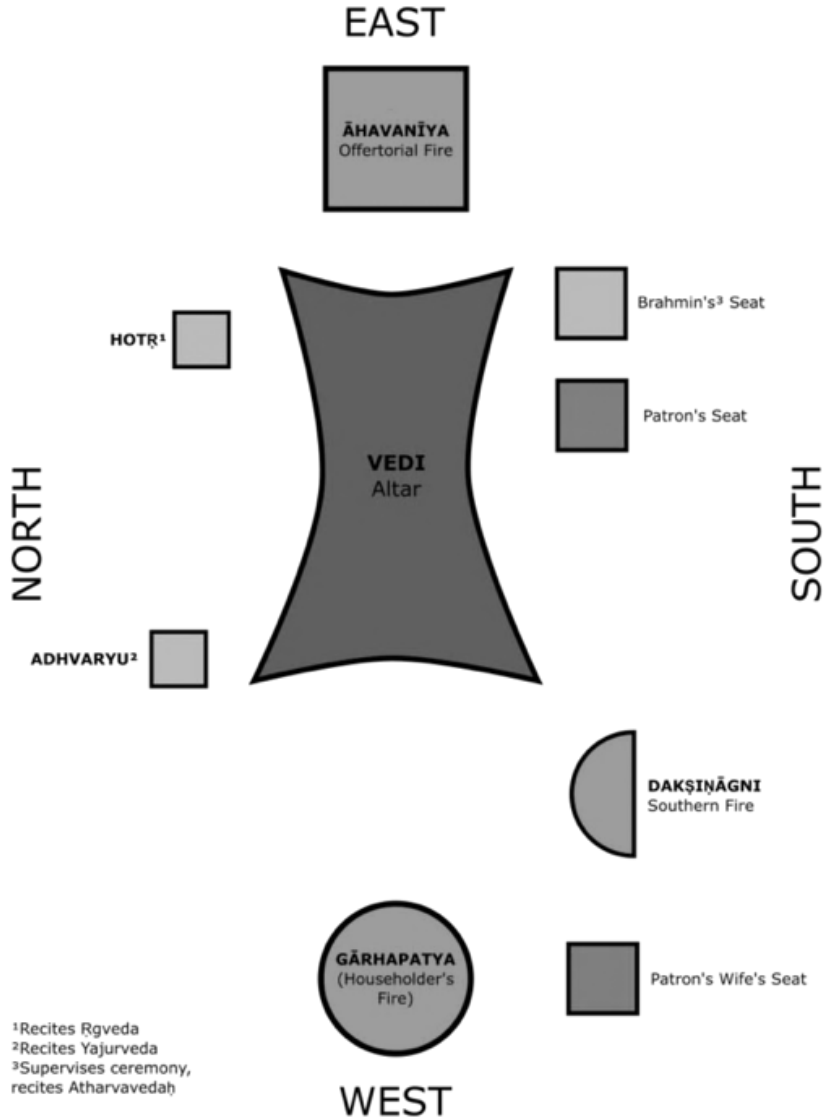
The Altars used for Yajna, were of the same area. We can see in the picture a circle holds the same area which is held by semicircle and square. For this, they must have minute knowledge of diameter, radius, circumference, ratio and geometrical operations for their transformations.

Baudhayan and Pythagoras Theorem ($a^2+b^2=c^2$)
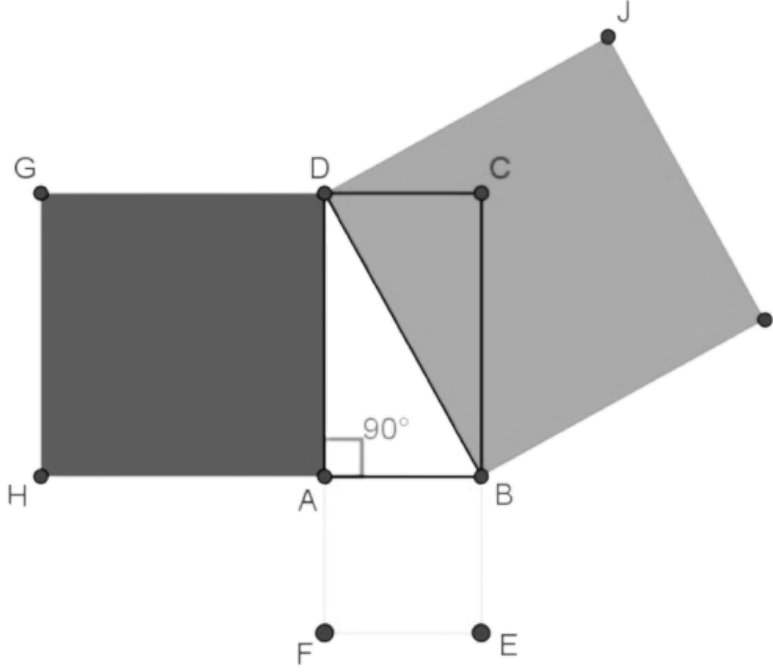
दीर्घचतुरस्त्रस्य अक्षणया रज्जुः पार्श्वमानी तिर्यग्मानी च यत् पृथग् भूते कुरुतः तदुभयं करोति ।

- Baudhayan Shulbsutra Ch 1.12

Bhuj koti Karni Nyay — When we stretch the rope along the length of diagonal of a rectangle, it creates an area which is equal to summation of an area which is made by the vertical and horizontal sides together.

'Square of the hypotenuse of a right-angle triangle is equal to the addition of the squares of other two sides.' This is the theorem of Pythagoras. This theorem has been mentioned in Shulbsutras, before over a millennium of Pythagoras. Furthermore, the Shulbasutras laid the foundations for concepts such as the approximation of the *pi* value, demonstrating a sophisticated understanding of spatial relationships in the sacred geometry used to build altars.
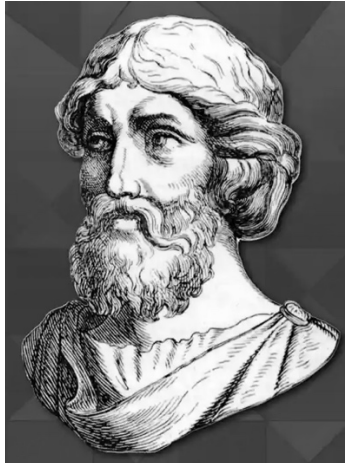
Source:http://www.myfavouriteplanet.de

<u>Do you know?</u>

During the attack of the Persians on Greece, they took many prisoners with them in their land. Pythagoras was one of them. But he used this bad time as fortune and spent almost 8 years in the western part of India near Takshashila where he got the idea of Geometry. When he went back in Italy at Crotona he established **Pythagorean order** based on the Ajivika and Jain school of India.

Ref — Bipin R Shah (RP)

Geometric transformations in Shulbsutra
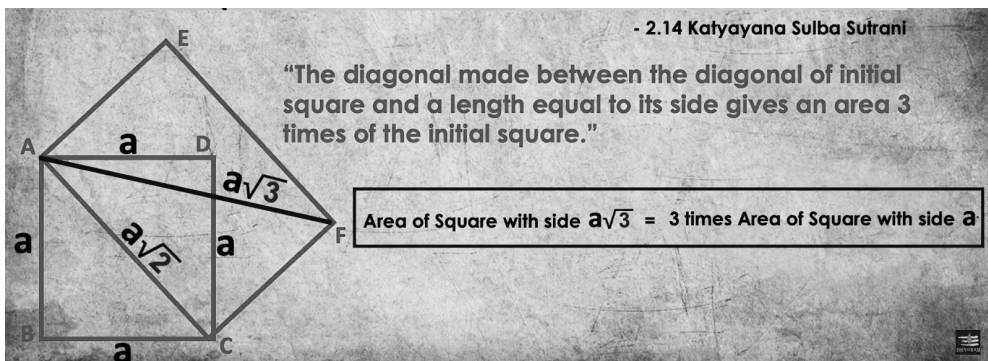
(i) प्रमाणम् तिर्यक् द्विकरण्यायां अस्तस्य अक्ष्णया रज्जुस्त्रिकरणी ।

(Katyayan Shulbsutra 2.14)

(The diagonal made between the diagonal initial square and a length equal to its side gives an area 3 times of the initial square)

(ii)   मण्डलम् चतुरसं चिकीर्षन् विष्कम्भ पञ्चदश भागान् कृत्वा द्वावुद्ध्रेचेषः करणी ।

(Katyayan Shulbsutra 3.14)

This formula states that using this sutra one can convert a circle into a square. The sutra gives following steps for the conversion:

1. Take any circle of diameter 'D'

   Consider a circle pf diameter 15 cms

2. Divide diameter into 15 parts

   One part is equal to 1 cm

3. Select 13 parts of this line and add 1/3rd of one part to it

   i.e. 13 cms + 1/3rd of 1 cm = 13.33 cms

4. This length of 13.33 parts form the side of a square, it has equal area to that of the above taken circle.

Contributions to Pi (π): Ancient Precision

Approximation of Pi (π), the ratio of a circle's circumference to its diameter, is one of the most astounding contributions of ancient Indian mathematics. Indian mathematicians, particularly those in the ancient classical period, had a surprisingly accurate understanding of *pi*. The early approximations of π found in Indian texts go beyond the mere geometrical observation of shapes and delve into the calculation of precision.

Since the Vedic period Indians have contributed in accuracy development of value of pi. We divide this development into 4 eras:

(1) Vedic era (3700 to 1500 BCE)

(2) Sautrantic Tradition (5th to 7th century)

(3) Medieval Indian Period (13th to 15th century)

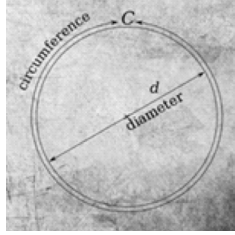**(4) Modern Indian Period (18th to 20th century)**

Here we will discuss only about first two eras.

Vedic era (3700 to 1500 BCE)

चतुरसं मण्डलम् चिकिर्षन् मध्यादासे निपात्य पार्श्वतः परीलिख्य तत्र यदतिरिक्तं भवति, तस्य

तृतीयेन सह मण्डलं परीलिखेत् समाधि :। (*Katyayan Shulbsutra 3.13*)

A rope when stretched across the circle, also goes 3 times around the circle.

Though this calculation was not as accurate as modern times value of Pi but it makes it very clear that Indian sages were on the voyage of finding the value of Pi. Indian sciences are not like water-tight compartments. Many subjects are found in one book. Like, in Vedas one can find ritualistic, religious, humanitarian, scientific, mathematical perspectives interwoven together.

Sautrantic Tradition (5th to 7th century)

Aryabhatta is one of the most eminent mathematicians and astronomers of India. We always credit him for the discovery of zero. But his huge work in astronomy, geometry and trigonometry surpasses this notion. Sautrantic period has seen many giants of maths like Brahmagupta, Varahmihir, Bhaskara I. Their work not only enlightened Indian education but the flame of this knowledge also flared in western part of the world. Through Arabs it migrated into western world. Here we will study some of the works of Aryabhatta. Aryabhattiya, the book written by Aryabhatta, contains 4 sections named as *Pada*. In one of its sections, Ganitapada he states:

चतुरधिकं शतमष्टगुणम् द्वाशष्टिस्तथा सहस्राणाम् ।
अयुतद्वयविष्कम्भस्यासन्नो वृत्तपरिणाह: ॥

"4 added in 100, multiplied by 8 and added 62,000 into that, it is the circumference of a circle having diameter of 20,000."

$\Pi = 62,832/20,000 = 3.1416$

Aryabhatta also tried to calculate area of a circle without π. He states:

$$संपरिणाहस्यार्धं विष्कम्भार्धहतमेव वृत्त फलम्$$

Half of the circumference when multiplied by half of diameter exactly gives area of the circle. Area of circle = ½ C × R

In the *Aryabhatiya* (5th century CE) by Aryabhata, one of India's most eminent mathematicians, a remarkable approximation of π is provided as 3.1416,] which is extraordinarily close to the modern value of 3.14159. Aryabhata also mentions the value of π in terms of a method for calculating the circumference of a circle. This text, along with subsequent works by other mathematicians such as Brahmagupta and Bhaskara, showcases India's mastery over number theory, arithmetic, and geometry.

What is particularly noteworthy is the level of accuracy Indian mathematicians achieved without the aid of advanced tools such as the compass or the modern mathematical understanding of limits and calculus.

Magic Squares: Mystical Mathematics

Magic squares are one of the most fascinating aspects of ancient Indian Mathematics. The most wonderful thing about these grids is vertical, diagonal and horizontal addition of all these boxes is equal. This concept is very native and known to India before the introduction to Western world. This common sum is commonly known as 'magic constant' or 'magic number'.

The credit of constructing the magic squares goes to *Cornelius Agrippa* (1486 BCE to 1535 BCE) of China. There they call it as *Loh Shu*. Journey of the interest of magic square starts from China to Japan to India and then to middle east. During Byzantine times it was introduced to Europe.

20	6	
9	15	14
	11	10
8		19

Nagarjuna was the first Indian mathematician who introduced the magic square of series 4, in the Indian subcontinent.

Along with their recreational value. Magic squares also possess several advanced mathematical utilities. In day-to-day life, some problems related to a division of objects equal in numbers and value can be easily solved by magic square.

Circular Geometry: The Circle of Life

Circular geometry, particularly the study of spheres, circles, and their properties was another area where ancient Indian mathematicians excelled. The Suryasiddhanta, an ancient Indian astronomical text, provides insight into the study of spherical geometry, especially in the context of celestial bodies and their movement. The text describes methods for calculating the positions of planets and stars, incorporating advanced concepts of spherical trigonometry.

The Vedic scholars were also well aware of the relationship between angles and circles, evident in their work on astronomical instruments such as the *gnomon* (a device used for measuring time) and *astrolabes*. The accurate measurement of celestial bodies' movements required a deep understanding of the geometry of spheres, and Indian mathematicians had a remarkable ability to calculate such movements.
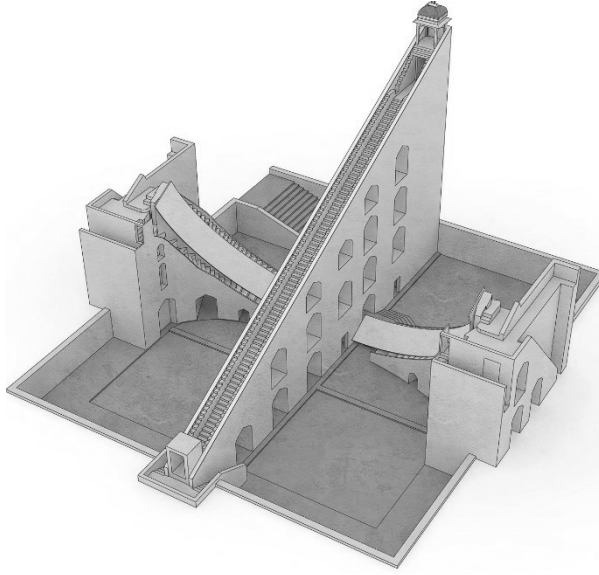
The Bhoot-Sankhya System: The Digital Mysticism

The Bhoot-Sankhya system, or the system of counting based on numerals and their mysticism, was another fascinating aspect of ancient Indian mathematics. This system incorporated a method of counting that not only dealt with numbers but also with the spiritual and metaphysical dimensions of numbers.

Saṃkhyā	Śabda
0	Ananta, Antarikṣa, Abhra, Ambara, Ākāśa, Khaṃ, Kha, Gagana, Vyoma, Śūnya
1	Indu, Urvarā, Urvī, Eka, Kali, Go, Gotra, Candra, Candramas, Dharaṇī, Dharā, Dharitrī, Pṛthvī, Brahmā, Bhū, Vāk, Himāṃśu
2	Akṣa, Īkṣaṇa, Oṣṭha, Kara, Karṇa, Cakṣu, Jānu, Dṛṣṭi, Nayana, Nāsatya, Netra, Pakṣa, Pāṇi, Bāhu, Bhuja, Bhujā
3	Agni, Guṇa, Jagat, Rudrākṣa, Śivanetra, Śūla
4	Abdhi, Ambunidhi, Āmnāya, Āśrama, Dik, Diś, Diśā, Lokapāla, Varṇa, Veda, Śruti, Samudra
5	Indriya, Tattva, Tanmātra, Pāṇḍava, Prāṇa, Mahābhūta, Mahāvrata, Ratna, Vrata

6	Aṅga, Ṛtu, Kāya, Kāraka, Darśana, Dravya, Rasa, Rāga, Ripu, Varṇa, Śāstra
7	Aśva, Ṛṣi, Giri, Chanda, Chandas, Dvīpa, Dhātu, Mātṛkā
8	Anuṣṭubh, Diś, Nāga, Nāgendra, Mataṅgaja, Mati, Mada, Mātaṅga, Yūthapa, Vana, Vasu, Siddhi, Hastin
9	Aṅka, Antara, Ambujāsana, Upendra, Ṛddhi, Kapāṭa, Kavāṭa, Kavi
10	Aṅguli, Avatāra, Dikpāla, Rāvaṇaśiras
11	Akṣauhiṇī, Aja, Īśa, Īśāna, Īśvara, Giriśa, Mahādeva, Maheśa, Maheśvara
12	Arka, Āditya, Bhānu, Bhāskara, Mārtaṇḍa, Māsa, Mitra, Rāśi, Haṃsa
21	Kratu, Prakṛti, Makha, Yajña, Svarga

In this system, each number was associated with a specific element of the universe representing a specific number. Ex Sun, moon, earth they all represent singularity i.e. one whereas elements (Bhoot), kosha give number five. Above list is depiction of this endless numbers through words. This conversion of numbers into words or verses is a quest to remember intricate and complicated numbers. Most of the time we get confused considering these verses as a prayer of God or an ayurvedic formula but a secret number is embedded in it.

Let's see an example:

विबुध-नेत्र-गजाहि-हुताशन त्रि-गुण-वेद-भ-वारण-बाहवः ।
नवनिखर्वमिते वृतिविस्तरे परिधिमानमिदं जगदुर्बुधाः ॥

Step I –   विबुध – Gods = 33   नेत्र – Eyes = 2
            गजाहि – Elephants = 8   हुताशन – Fire = 3
            त्रि = 3   गुण – Gunas = 3
            वेद = 4   भ – Nakshtras = 27
            वारण – Elephants = 8   बाहवः – arms = 2

Step II –   Arrange all these numbers back to forth.

2827433388233

नवनिखर्वमिते वृतिविस्तरे परिधिमानमिदं जगदुर्बुधाः ॥

नव – 9 　　　　　　　　**निखर्व** – 9×10^{11}

Taking this ratio will yield us the value of Pi (π)

$$\frac{2827433388233}{9 \times 10^{11}} = 3.1415$$

(This is an approximation of Madhavacharya's approximation of Pi)

π

The Katapayadi System: A Code of Numbers

Another intriguing system that emerged from ancient Indian mathematics is the Katapayadi system, a numerological technique used for encoding numbers in letters. In this system, each letter of the Sanskrit alphabet was assigned a numerical value, and the words formed by these letters could be used to represent large numbers. This system was used extensively in the calculation of astronomical numbers, as well as in the codification of large numbers in texts like the Suryasiddhanta.

The Katapayadi system is a brilliant example of how the Indian tradition intertwined linguistic and numerical knowledge, creating a system where language itself could carry mathematical meaning. It served as an early precursor to modern-day cryptography and the use of symbolic languages for mathematical purposes.

Here we will see an example:

आयुरारोग्यसौख्यम्

Step-I : All vowels stand for zero so in this case, the digits are 0-1-2-2-1-7-1

Step-II : Write numbers from back to forth and it becomes 1,712,210

Conclusion: The Timeless Legacy of Vedic Mathematics

The mathematical advancements of ancient India, from the profound geometry of the Shulbasutras to the mystical wonders of magic squares, Pi approximations, and the systems of astronomy, have left an indelible mark on the development of mathematics worldwide. The Vedic mathematicians were not just abstract theorists; they were practical innovators who applied their knowledge to real-world problems in architecture, astronomy, and even spirituality.

The methods and systems they developed continue to influence modern mathematics, and their insights into number theory, geometry, and the cosmos show a deep understanding of the universe's structure, harmony, and order. The legacy of Vedic mathematics is one that continues to inspire and captivate mathematicians, scientists, and scholars across the globe, serving as a testament to the timeless nature of human inquiry and intellectual achievement. In the coming chapters, we will delve deeper into how these ancient mathematical systems can be understood and applied in the modern world, continuing the journey of discovery that began thousands of years ago in ancient India.

6.

Astronomical Observations in India

Chandra, the Moon God, was married to 27 Nakshatras (daughters of King Daksha), but he loved Rohini the most and spent most of his time with her, neglecting his other wives. Upset by this, the other Nakshatras complained to their father, Daksha, who cursed Chandra to lose his brightness and fade away. Worried, Chandra prayed to Lord Shiva, who softened the curse, allowing him to wax and wane in cycles.

The Above story of Chandra and Rohini apparently seems to be a mythological and imaginary story, and of course it is. But a great astronomical insight is embedded in this story. Our task is to find it out. It shows how Ancient India made significant contributions to the field of astronomy, forming an integral part of the Indian Knowledge System (IKS). This system, deeply rooted in Vedic traditions, combined mathematics, philosophy, and observations to develop sophisticated models of celestial phenomena. Indian astronomy, known as Jyotisha, played a crucial role in timekeeping, religious rituals, and navigation. You might have wondered in

your life why Christmas comes always on 25th December and why not Diwali comes in the same month. Even

In this chapter we will see some key contributions of Indians in the field of astronomy.

Concept of a Day

In Jyotisha: A Vedic day is a 24-hour period that begins with the sunrise and ends with the dawn of the next day. There are two parts to this time period: daylight and nighttime. Daytime is defined as the time between sunrise and sunset, while night-time is defined as the time between sunset and dawn the next day. Then these two periods are split into 12 equal-length hours, known in Vedic astrology as planetary hours or hora.

Aryabhatiyam also explain order of the weekdays and their association with various planets (grahas). Aryabhatiyam (Kalakriya Pada, verse, 16) writes:

<div align="center">

समैते होरेशा: शनैश्चराद्या यथाक्रमं शीघ्रा: ।

शीघ्रक्रमाच्चतुर्था भवन्ति सुर्योदयात् दिनपा: ॥

</div>

In ancient times, due to the absence of large telescopes and the inability to see distant planets, only seven planets were considered. These included Mars, Mercury, Jupiter, Venus, and Saturn. The Moon and the Sun were also counted among them. Here, let us try to understand the process by which the days of the week were named.

1. A week consists of seven days, and each week begins with Sunday.
2. Arrange all the planets in a straight line based on their speed. The slowest-moving planet is Saturn, followed by Jupiter, then Mars, Sun, Venus, Mercury, and Moon.
3. Now, the order of our planets becomes as follows: Saturn, Jupiter, Mars, Sun, Venus, Mercury, Moon.
4. Assign each of these planets to the 24 hours of a day.

5. After 24 hours are completed, the remaining planets continue to be assigned to the hours of the next day starting from the first hour.

6. Now, the order of our weekdays becomes as follows: Saturday, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday.

7. The planet that appears in the first hour of the day becomes the ruling planet (dina-pati) of that day. For example, the ruling planet of Monday is the Moon.

Sunday (Ravivar) – Sun   Thursday (Guruvar) – Jupiter

Monday (Somvar) – Moon   Friday (Shukravar) – Venus

Tuesday (Mangalvar) – Mars   Saturday (Shanivar) – Saturn

Wednesday (Budhvar) – Mercury

Similar explanation is found in Surya Siddhanta (Bhugoladhyaya-78) which says:

मन्दादधः क्रमेण स्युश्च्यतुर्था दिवसाधिपः ।
होरेशा सुर्यतनयादधोधः क्रमशस्तथा ॥

Source: https://www.gettyimages.in/photos/big-bang

नासंदासीन्नो सदांसीत्तदानीं नासीद्रजो नो व्योमा परो यत् ।
किमावरीवः कुह कस्य शर्मन्नंभः किमासिद्गहनं गभीराम ॥

45

Nasadiya Sukta RuchaThe Nasadiya Sukta (Hymn of Creation) from the Rigveda is one of the earliest philosophical and cosmological texts. It questions the origin of the universe and time, presenting an early form of speculative astronomy.

Indian Months and Ritu

Seasons are based on the movements of the earth around the sun. The following table shows how the Hindu months are kept in sync with the seasons.

Seasons (Indian Names)	Indian Month	Western Month
Vasant (spring)	Fagun – Chaitra	April - May -June
Grishma (summer)	Vaisakh – Jyestha	May -June-July
Varsha (monsoon)	Ashadh – Shravan	July-August-September
Sharad (winter)	Bhadrapad _Ashwin	October-November – December
Hemant (winter)	Kartikeya - Margshirsh	December - January- February
Shishir (fall)	Poush – Magha	February - March – April

Indian Calendar – Panchaang System (Luni Solar Calendar)

Indians followed different types of panchanga varying from region to region. Since ancient times, Indians have majorly followed two types of calendrical systems (i) Solar and (ii) Luni-solar. The calendrical system which is purely based on the Sun's position is called the Solar calendar. The Solar year starts when the Sun reaches in the star 'Mesha' in the Ecliptic. It occurs mostly around April 14th.

Let's see about the five limbs of the Panchang briefly. 5 limbs of Panchang are:

1) Vara (वार)   2) Tithi (तिथि)

3) Nakṣhatra (नक्षत्र).   4) Yoga (योग)

5) Karaṇa (करण)

Vara (वार)

Vara is a natural day i.e solar day. In Indian context a day starts from the sunrise to next day sunrise unlike European methods where it starts at

night. Solar day consists of 24 hours and to be more precise it is 23 hours, 56 minutes and 4 seconds. Due to slowing down the Earth's rotation, variation comes in a day by 1 second every four years.

Tithi (तिथि)

What exactly the Tithe is, let us understand the concept first. Firstly, the interval between two Amavasya or two Purnima is called as a lunar month. On new moon day the sun and moon are in the conjunction. It happens when the moon comes between the sun and the earth. 1° movement of the sun is equal to 13.17° of the moon. It means everyday an angular separation of the sun and the moon increases by 12°. It means that the sun and the moon would be in conjunction again after 29.5 days. This period is known as a Lunar Month or Chandra Masa.

In a Lunar month there are 30 tithis and are divided into two parts: Shukla Paksha (14) & Krishna Paksha (14). 15th day either will be a full moon day (Paurnima) or new moon day (Amavasya). Tithis start from Pratipada (Feminine 1st in Sanskrit) to Chaturdashi (Feminine 14th in Sanskrit) in each paksha. This angular separation is not uniform for all the days so duration of tithi is also not equal.

Nakshatra (नक्षत्र)

With the frame of reference of the earth, movement of the sun has been divided into 12 imaginary sections in the space. We call them as Zodiac signs, rashi in Indian calendar. This zodiac signs are representation of angular movement of the sun in 360 degrees, 360°/12 = 30° (47pprox..). Same like that the moon also completes its orbit through 27 constellations known as Nakshatras.

Yoga (योग)

In Sanskrit literal meaning of yoga is to join or add. Yoga is summation of longitudes of the sun and the moon. In Sadratnamala, it is mentioned,

सूर्यस्फुटाढ्ये चन्द्रे तु तयोर्योगस्फुटं भवेत्॥ (Sadratnamala 3.19)

It means that, longitude of the moon to which longitude of the sun is added is equal to longitude of the yoga.

In other words, the time during which the joint motion of Sun and Moon is 13°20' (which is 1/27th of th zodiac) is called Yoga. Calendars that we use now, we can easily spot out yogas as amṛta, siddha, maraṇa, which are determined by combination of some days and certain Nakṣatras.

Karaṇa (करण)

Karaṇa is nothing but half part of tithi. Karaṇa is the duration when the angle of separation between Sun and Moon is 6°. There are 60 half tithis in a Lunar month. There are 11 karaṇas.

The Rashi Chakra (Zodiac Wheel)

It is divided into 12 Rashis (Zodiac Signs), each spanning 30 degrees of the ecliptic plane. This division helps in astrological predictions and timekeeping. Rashi is an astronomical and astrological term used in the Indian calendar to monitor the movement of celestial bodies for space band through which the sun, moon and planets move as seen from the earth. Rashi contains a number of constellations, and the sun is said to be in that Rashi when it passes through the portion of the zodiac that includes that constellation.

The zodiac can be traced back to ancient civilizations, such as ancient Greeks and Romans, who believed the position of heavenly bodies could be used to predict the future. For them, astronomy and astrology were one and the same—which is definitely not the case anymore!
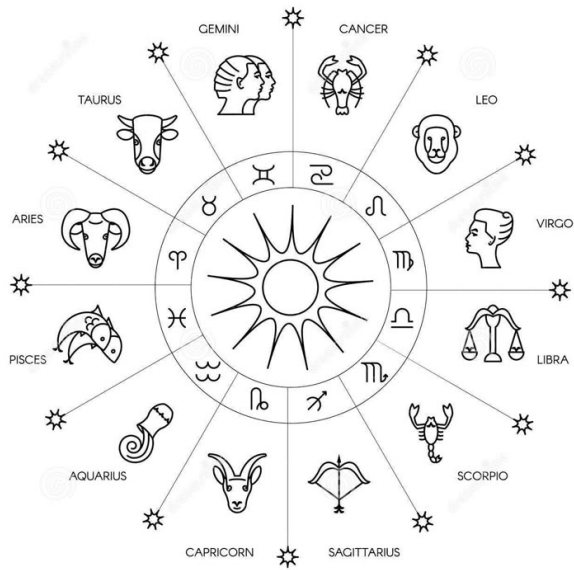
Adhikmaas

Indian calendar system is combination of the movement of the sun and the moon so we call it as Luni-solar calendar. Lunar month has 29.5 days unlike the solar month having 30 or 31 days. So a lunar year comprises of 354 days whereas solar years consists of 365 days. Every year there is a difference of 11 days between the lunar and solar year and this difference goes up to 29 or 30 days after 3 years and becomes almost a complete month. To adjust this difference and to make the lunar and solar calendars similar, the lunar month must be compensated with 1 extra month and it is called "Adhikmaas" (an extra month).

But the question remains, why to adjust. The reason is very simple. In the Indian subcontinent, Indians have designed all their festivals, seasons, and religious rituals as per the movement of the moon. If this difference is not adjusted, our festivals will not follow the seasons, and Diwali may come in Summer or in Monsoon. And solar calendar keeps us aligned with other worlds. So Indian calendar is the most scientific calendar of the world.

In 2023, there was an extra month or Adhika Masa, as per the Indian

(lunar) calendar. Adhika Masa comes in every 3 years. After 2023, the next Adhik Maas will fall in the year 2026, called Jyeshth Adhik Masa, from 17th May to 15th June.

Eclipses

Ancient Indian astronomers were very well aware of the scientific causes of the lunar and solar eclipses even before Aryabhatta. The procedure of eclipses is very well narrated in Panchsiddhantika.

Āryabhatta I (b. 476 A.D.) explain the causes of the two types of eclipses and explains in his characteristic style of sutra:

<div align="center">छेद्यति शशी सूर्यम् शशीनाम् महती च भूच्छाया</div>

- "The Moon covers the Sun and the great shadow of the Earth (eclipses) the Moon".

Causes of the Lunar Eclipse

The sun and the moon are on opposite sides of the earth on a full moon day. The sun's rays fall on one side of the earth and another side has its shadow. When moon comes in shadow of the earth, lunar eclipse occurs. It happens when the difference between the celestial longitudes of the sun and the moon is 180°.

However, on every full moon day a lunar eclipse does not occur owing to the inclination of moon's orbit by 5°. There would have been a lunar eclipse on every full moon day if the moon's orbit was in the plane of ecliptic. On a full moon day, generally, the moon will be either far above or far below the plane of ecliptic and hence not passes through the shadow of the earth. But, on that full-moon day, when the Moon does pass through the earth's shadow, a lunar eclipse occurs.
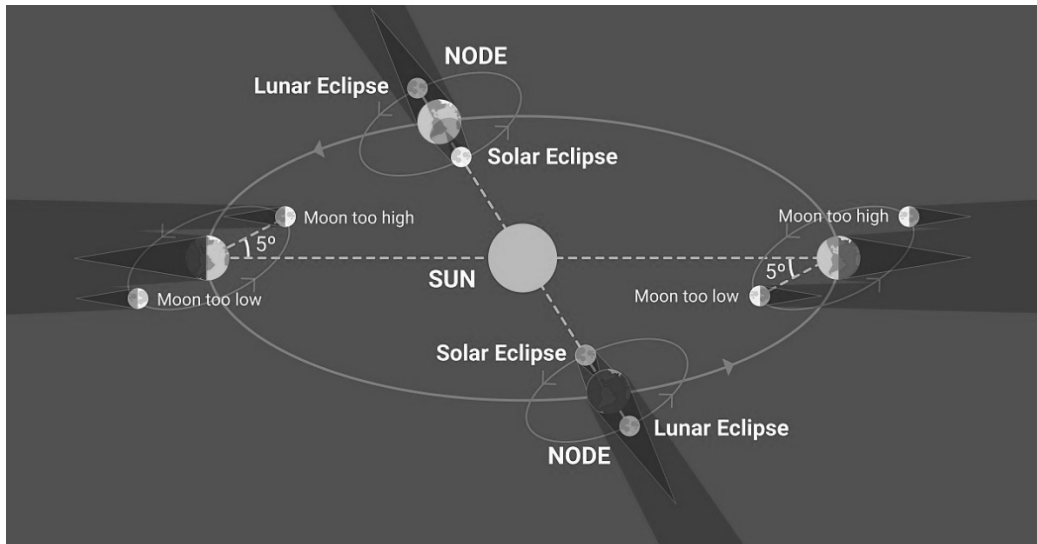
Geocentric and Heliocentric Models

As per astronomy, heliocentrism can be viewed as the Sun being in the middle of the Solar System or Universe. The word comes from Greek (Helios means "Sun" and kentron means "Centre"). Historically it can be said to be opposed to geocentrism, which takes Earth as its centre. In 16th & 17th centuries, Copernicus, Galileo and Keplar resurrected and maintained the thesis and sparked a great debate.

Copernicus was not the first to propose a heliocentric modal of the universe where the earth revolves around the sun and not vice versa. For their ground breaking discovery of that era all these scientists either persecuted or punished. But India always had freedom to challenge established notion of not only science but also religion. Aryabhatta (476 CE) proposed a heliocentric model, where Earth rotates on its axis.
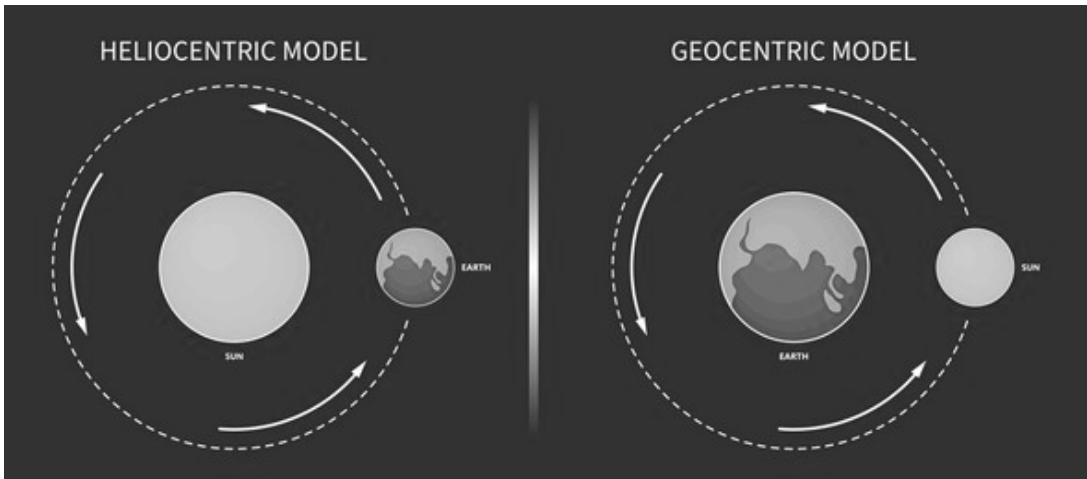
Equinox and Solstice

Uttarayan, 22nd December (Winter solstice) and Dakshinayan, 22nd June (Summer solstice) always occur on the same date undoubtedly. In between these solstices we have 2 equinoxes occurring on 21st March (Spring equinox) and 23rd September (Autumnal equinox).

These are the four cardinal points of the Zodiac and four quarters of a Year which are beyond any controversy.

Death of Bhishma

On the 10th day of Mahabharata war, Bhishma Pitamaha fell from his chariot. Commander in chief Bhishma expressed his will to wait for 58 days till the sun changes its direction and move towards north known as Uttarayan. Actually, he was waiting for the beginning of Uttarayan Punyakalam (winter solstice). He was blessed by his father Shantanu with a boon to die whenever he wants (Sweccha Maranam). As it was considered auspicious to die in Uttarayan.

Source: https://sk.pinterest.com/pin/149674387610215575/

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Notes:

7.

The compendium of Vedas

Among the oldest civilizations and cultures of the world, Indian civilization still stands as a torch bearer of ancient, holistic and sustainable knowledge. It is still a living culture. Though there are many debates and arguments about the antiquity of the cultures around the world, no one denies the Vedas as the most ancient scriptures of the world. Generally, we make mistake while comprehending Vedas considering them as religious texts. But they are great depositories of knowledge discovered and developed by Aryas. Arya too, is not an ethnic group but it represents a group of people having specific qualities. If someone asks when were Vedas composed, it is difficult to day that. Because Vedas are not written by a single person in a specific era but it is a compilation and observation of different sages at different timelines. That is why one can see the layers of languages, change thought process and rituals from time to time. Still briefly historians anticipate the time of Vedas from 2500 BCE to 500 BCE and call this period as a Vedic period.

पुराणन्यायमीमांसा धर्मशास्त्राङ्गमिश्रिताः।
वेदाः स्थानानि विद्यानां धर्मस्य च चतुर्दश ॥

The Vedas are the source of integral wisdom, science, tradition and culture of a remarkable civilization. They are Oral compilations of the wisdom of cosmic knowledge survived from the time immemorial. They are not only identified as scriptures but also as the fountainhead of Indian culture and human civilization. The word 'Veda' means 'knowledge' and is derived from the Sanskrit root 'vid', which means 'to know'. It does not refer to one single literary work but indicates a huge corpus of literature, which arose in the course of many centuries and has been handed down from one generation to another generation by verbal transmission. 'Veda' is also called 'Shruti' meaning what is heard, as opposed to the 'Smriti' composed by sages at a later stage recounting the content of the Vedic texts. This refers to the purely oral-aural method which was (and is) used for it.

Yajnavalkya Smriti refers to fourteen sources of knowledge. They are the Vedas (Rigveda, Yajurveda, Samaveda and Atharvaveda), Vedangas (Shikaha, Kalpa, Vyakarana, Nirukta, Chanda and Jyotisha), Purana, Nyaya, Meemamsa and Dharmashastra.

Importance of the Veda

1. It has been universally acknowledged that the Veda is the earliest available literature of humanity.

2. The Veda in the form of prose and poetry in Sanskrit language, has been regarded as authoritative knowledge. (शब्द-प्रमाण)

3. The Veda contains the highest spiritual knowledge (Para vidya) as well as the knowledge of the world (Apara vidya). Thus, apart from philosophy, we find here descriptions of various aspects of the different subjects such as sciences, medicine, political science, psychology, agriculture, poetry, art, music etc.

5. The Veda is unique in its purity and sanctity. The text of the Veda is preserved in its pure and original form without any alteration or interpolation even after thousands of years. The Veda is the only unadulterated treasure house of true knowledge. So much so that even UNESCO declared it as part of the Intangible cultural heritage of humanity. (https://www.unesco.org/en/culture http://www.unesco.org/culture/ich/en/RL/tradition- of-vedic-chanting-00062)

6. The Vedic language is marked by extreme economy of expression. Many time it seems to carry some deep hidden meanings indicating mystical truths. Often it makes symbolic impression. The wise souls, from the immediate successors of the Vedic seers right down to our times, have searched for and discovered the revelation of the deepest truth in the Vedic texts differently. That is the reason many commentaries and reference- books are written by the ancient and modern scholars for understanding the Veda and the Vedic concepts. This vast reference material further establishes the importance of the Vedic texts.

Geography

Where did Aryas live? The answer to this question we found in hymns of vedas. The region is called as Sapta Sindhu means the area which is drained by 7 rivers. The seven rivers included:

i) Sindhu   ii) Vitasta (Jhelum)

iii) Asikanai (Chenab)   iv) Parushni (Ravi)

v) Vipash (Beas)   vi) Shutudri (Satluj)

vii) Saraswati

After Harappan civilisation 2nd urbanisation started at the banks of Ganga River. Aryas gradually moved towards east and occupied the territory of Kosala (UP) and North Bihar (Videha) during later Vedic period. At this point we can see mixture of different languages with Vedic Sanskrit.

Structure

Vid (विद्) means to know. Vedas are not religious scripts. Though they are misunderstood as Hindu scriptures, but you will not find any word matching with 'Hindu' in whole text. They serve the purpose of only gaining knowledge.

Vedas are not written by a single person, but it is a compilation done through continuous journey of time. Many sages have contributed their thoughts and observations in these texts. As it is an evolved literature it has layers of development of thought process.

- **Rigveda**: oldest of all Vedic texts; contains ten *mandalas* (books) of 1,028 Vedic Sanskrit hymns
- **Samaveda**: second Vedic text; comprised of songs and chants. The melodies are called gāna; the remaining books are ārcika. Each section is further divided.
- **Yajurveda**: believed to be the third of the Vedic texts; primarily focused on worship and rituals
    - Krishna Yajurveda ("Black" Yajurveda)
    - Shukla Yajurveda ("White" Yajurveda)
- **Atharva Veda**: newest Vedic text (c. 1200-900 BCE). Contains rituals for everyday life (learning, marriage, funerals) as well as formulas for magic.

- **Samhitas**: mantras and benedictions
- **Brahmanas**: commentaries on rituals, ceremonies, and sacrifices
- **Aranyakas**: texts on rituals, ceremonies, and sacrifices (symbolic and otherwise)
- **Upanishads**: texts regarding meditations, philosophy, and spiritual knowledge

In this arrangement we can see that all vedas have been divided into 4 parts. They evolved as the thinking process of Vedic Rishis went into the depth of knowledge. It starts from mere mantras towards praise of natural deities (Samhita) to a great a plunge in the world of philosophy pursuing the root cause behind the creation of our universe.

Big Bang Theory

As stated in Big Bang theory the world evolved from a singularity. Singularity is an infinitesimally small, vibrant, self-sustaining and densely packed singularity. Though there is no theory behind the origination of mass and energy or how did singularity look like but scientist provide various views on this question. The only thing that we know is "that One thing, breathless, breathed by its own nature: apart from it was nothing."

Theory of Evolution as reflected in Rigveda:

नासदीय सूक्त (ऋग्वेद)

नासदासीन्नो सदासीत्तदानीं
नासीद्रजो नो व्योमा परो यत्।
किमावरीवः कुह कस्य शर्मन्नम्भः
किमासीद्गहनं गभीरम्॥ १॥
न मृत्युरासीदमृतं न तर्हि

न रात्र्या अह्न आसीत्प्रकेतः ।
आनीदवातं स्वधया तदेकं
तस्माद्धान्यन्न परः किं चनासं ॥ २॥

Vedangas

One cannot understand the language, perspective and meaning of these verses without having the knowledge of following sciences which are called as *Vedangas*. They are inalienable part of the text so they are called as organs of vedas. They are six in numbers and they are:
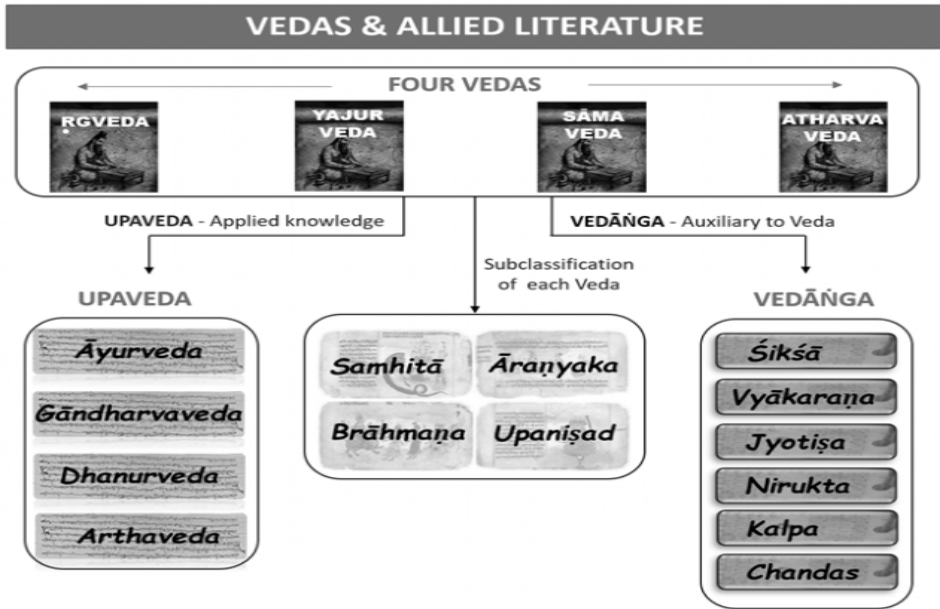
Siksha (Phonetics-Nose)

In vedic context siksha means a discipline of phonetics. Shiksha lays down the rules for pronunciation, duration of utterance of sound, style of saying it. The ultimate goal of shiksha is to attain perfection in pronunciation so that only correct word to be carried forward generation to generation. Sanskrit is a language where sound and letters exactly match with other unlike English language where spelling is one and pronunciation is something

else. The beauty of sanskrit language is its sounds and letters go hand in hand.

Vyakarana (Grammar-Mouth)

The second Vedanga is Vyakarana or grammar, which is necessary for the understanding of the Veda. Vyakarana deals with Sanskrit grammar providing useful insights into the usage of words and sentences leading to the mastery of the language. Words and their forms are arranged in such a way in sentences that whatever sequence you put them into it will not lose its core meaning. Observe the change of meaning in English and Sanskrit language through the following table.

Sanskrit	English
अनिल: हस्तेन अन्नं खादति ।	Anil eats food by hand.
हस्तेन अन्नं खादति अनिल: ।	By hand food eats Anil.
अन्नं खादति अनिल: हस्तेन ।	Food eats Anil by hand.
खादति अनिल: हस्तेन अन्नं ।	Eats food by hand Anil.

Panini's Ashtadhyayi is the only representative of this Vedanga. It discusses how words can be formed and joint together to make new words with different meaning. By adding Upsarg (prefix) and pratyay (suffix) to prakriti (root words). The book has been composed in aphorisms i.e sutras. 14 sutras are referred as Maheshwar sutras. It is believed that they are originated from Natraja's damru sound. It must be likely because Panini was a devotee of Lord Shiva. These 14 sutras are considered to be the foundation of grammar. Patanjali has written a commentary on it called Mahabhashya.

Jyotisha (Astronomy & Astrology-Eyes)

It deals with vedic astrology / astronomy. It was basically designed to help to decide the most favourable time for the performance of vedic rituals; this is to indicate the measure of success or lack of it when vedic rituals are performed under the influence of a particular graha, nakshatra, tithi etc.

Mathematics is an integral part of it because it involves intricate mathematical operations.

Jyotisha has 3 parts. Namely

1. **Siddhanta Skandh** : It deals with trigonometry, arithmetic, algebra, geometry etc

2. **Hora Skandh** : It deals with the movement of plantes and their effect on people etc

3. **Samhita Skandh** : It deals with aspects like the location of underground waters, designing and building houses, omens etc.

Vedang Jyotish is the most ancient treatise on astronomy. It covers basic astronomy like principle of gravitation, rotation and revolution of the earth. Aryabhatta, Varahmihir and other astronomers of India have given beautiful discussions on these and other astronomical concepts. Thay also have tried to calculate origin of creation using astronomical principles. The Samkalpam which we perform before doing any ritual is based on such calculations.

Nirukta (Thesaurus of synonyms)

To understand the real meaning of any verse, only understanding the literal meaning of a word is not enough. One word can have different meanings so one needs to understand the contextual meaning of words. If you see the context meaning of a word may change. Nighantu is a collection of Vedic words. In later years it became very difficult to understand the meaning of Vedas. Around 6th to 7th century BCE Yaska understood the problem of deciphering the meaning of Vedic words and composed Nirukta. Nirukta is an etymological commentary of Yaska on Nighantu.

Kalpa (Manual for rituals-Hands)

Kalpa gives manual for living life well. It talks about functions of Brahmcharis, Grihastya and Sanyasis. It also talks about the process through which ritual should be done. It also talks about the number of priests

performing Yagyas & what vessal of what shape, size to be used etc. Kalpashastra has been compiled by many sages like Baudhayan, Manav, Apasthambha and Vaikhanas. There are 4 types of kalpsutras.

i) **Dharmasūtra**– deals with religious and social laws

ii) **Gṛhyasūtra** – deals with domestic ceremonies

iii) **Śrautasūtra**– deals with rituals

iv) **Śulbasūtra**– deals with the measurement of fire altars by geometrical calculations

Chanda (Metrics-Feet)

Chanda is science of versification. Rucha or verses must be composed in specific pattern so that it will be transferred from generation to generation intact. If it is not encoded in specific metrics, in the course of time new words can be possibly added and will change the meaning. This Set of rules is called Chandashastra. It was composed by Pingala. It is completely dedicated to Vedic Prosody. It mainly deals with Rigvedic metres.

Identification of Laghu and Guru: An example

यदा यदा हि धर्मस्य ग्लानिर्भवति भारत ।
अभ्युत्थानमधर्मस्य तदात्मानं सृजाम्यहम् ॥

yadā yadā hi dharmasya glānirbhavati bhārata |
abhyutthānamadharmasya tadātmānaṃ sṛjāmyaham ||

ya	dā	ya	dā	hi	dha	rma	sya	glā	ni	rbha	va	ti	bhā	ra	ta
L	G	L	G	L	G	G	G	G	G	L	L	L	G	L	G

a	bhyu	tthā	na	ma	dha	rma	sya	ta	dā	tmā	naṃ	sṛ	jā	mya	ham
G	G	G	L	L	G	G	L	L	G	G	G	L	G	L	G

Let us denote laghu by the number "1" and guru by the number "0".
This will convert the above table into a binary word of length 16

Using binary language of Laghu & Guru one can know about the type of Chandas. *Pingala* was the first who set numbers for letters. In computer machines also we use same process.

Meter	Structure	Mapped Sequence	Varieties	Usage
Gayatri	24 syllables; 3 verses of 8 syllables	6x4	11	Common in Vedic texts Example: Rigveda 7.1.1-30, 8.2.14
Ushnish	28 syllables; 2 verses of 8; 1 of 12 syllables	7x4	8	Vedas, not common Example: Rigveda 1.8.23-26
Anushtubh	32 syllables; 4 verses of 8 syllables	8x4	12	Most frequent in post-Vedic Sanskrit metrical literature; embedded in the Bhagavad Gita, the Mahabharata, the Ramayana, the Puranas, Smritis and scientific treatises Example: Rigveda 8.69.7-16, 10.136.7
Brihati	36 syllables; 2 verses of 8; 1 verse of 12; 1 verse of 8 syllables	9x4	12	Vedas, rare Example: Rigveda 5.1.36, 3.9.1-8
Pankti	40 syllables; 5 verses of 8 syllables	10x4	14	Uncommon, found with Tristubh Example: Rigveda 1.191.10-12
Tristubh	44 syllables; 4 verses of 11 syllables	11x4	22	Second in frequency in post-Vedic Sanskrit metric literature, dramas, plays, parts of the Mahabharata, major 1st-millennium Kavyas Example: Rigveda 4.50.4, 7.3.1-12
Jagati	48 syllables; 4 verses of 12 syllables	12x4	30	Third most common, typically alternates with Tristubh in the same text, also found in separate cantos. Example: Rigveda 1.51.13, 9.110.4-12

3.4 Deities in vedas

The concept of God in vedas emerges from gratitude towards the nature. So you can see all gods in vedas represent nature like Agni (fire), Indra (thunder), Varun (cosmic order) Savitru (sun), Usha (dawn) etc. They

imagined these gods in anthropomorphic forms. They worshipped them through Yagyas and so a great chain of rituals evolved in upcoming time to please these deities. Yajurveda deals with all the concerned rituals of yagyas. Gods of todays context are rarely or not at all found in vedas. Like, Vishnu is not as powerful as we consider him in todays' context. Indra was the most powerful god in Vedas.

Find out the God in Greek mythology having same powers of Vedic Gods.

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8.

Metallurgy

Source: https://www.etsy.com/in-en/listing/sword-talwar-damascus-steel-blade-silver

Introduction

Where did this technology emerge from? It, of course, cannot be an accident or a sudden discovery. There was chain of science in India. It was not merely theoretical but was in use. India's universities were thriving with this knowledge. Foreign travellers halt not while admiring this technology. It was a traditional practice of Indians which kept these science alive in India. In this chapter we will try have a look in glorious metallurgical history of India and its development in future. Ancient India made remarkable contributions to the

fields of metallurgy and chemistry. This chapter explores the indigenous techniques, texts, and discoveries in these fields, demonstrating how they shaped technological and industrial progress in India.

> **We find many mediterranean literary sources which state the import of steel from India. One of them is about Alexander who has been portrayed while being presented 100 talents of of Indian Steel by King Poras. Arabs took ignots of Wootz steel to Damascus following a thriving industry of weapons known as Damascus Sword.**
>
> **Arab Edrisi (12th century) mentioned "The Hindus excelled in the manufacture of iron and that it was impossible to find anything to surpass the edge from Indian steel."**

Early Developments in Metallurgy

India has a long tradition of extracting and working with metals. The Vedas, especially the Rigveda and Yajurveda, mention various metals, including gold (*Suvarna*), silver (*Rajata*), copper (*Tamra*), iron (*Ayas*), and tin (*Trapu*).

- Harappan Civilization (3300–1300 BCE): Excavations at Harappa and Mohenjo-Daro reveal that the Indus Valley people had developed copper and bronze tools, indicating knowledge of alloying.
- Iron Age (1200 BCE onward): The transition from copper to iron led to advancements in agriculture and warfare. The Atharvaveda mentions iron (*Shyama Ayas*), suggesting early knowledge of iron smelting.

Case Study: 1
Wootz Steel: The High-Carbon Indian Steel

Wootz steel, known for its superior quality, was produced in India as early as 300 BCE. The Tamil Sangam literature mentions high-quality steel exported to the Roman Empire and the Middle East. Cyril Stanley Smith's writings brought global attention to this material in many ways. Wootz steel

was very well known all around the world for nearly two millennia and one very famous product made of this Indian steel came to be known as the Damascus swords. These swords were well known for their sharpness and resilience. The legend goes that it could cut a very thin cloth in the air. The sword shown in the figure is a splendid example of the Wootz steel.


Robert Hadfield (creator of Mangalloy in 1882) studied crucible steel from Srilanka in 1912, recorded that Indian Wootz steel was far superior to the steel produced in any part of the Europe. Kodumanal (3rd century BCE - a village from Tamilnadu) artefacts suggest *crucible ferrous processing*. Another site of Konasamudram in Telangana was a world renowned centre to which merchants from Persian and other countries commute for steel long before emergence of Sheffield, Pittsburg and Jamshedpur.

In India, until the 19th century, swords and daggers of wootz steel were made at centres including Lahore, Amritsar, Agra, Jaipur, Gwalior, Tanjore, Mysore and Golconda, although none of these centers survive today.

Case Study: 2
The Iron Pillar of Delhi

The Iron Pillar of Mehrauli (4th CE) is an engineering marvel that has resisted corrosion for over 1,600 years. Made of wrought iron with a high phosphorus content, it exemplifies advanced metallurgical knowledge. The Iron Pillar is believed to have been erected during the reign of Chandragupta II (375–415 CE) of the Gupta Dynasty. It Weighs 6 tonnes and height goes upto 7.2 metres.
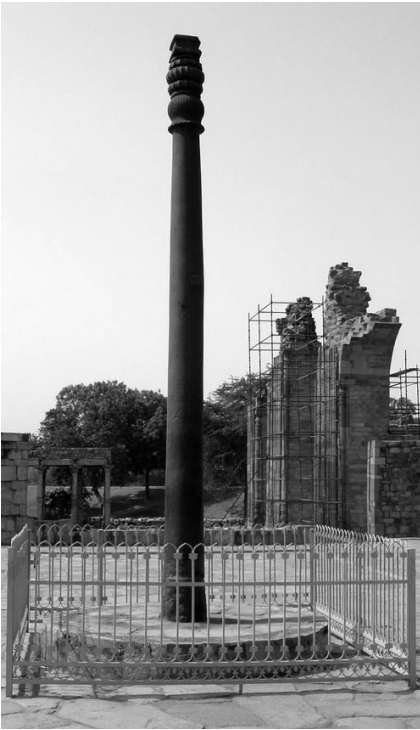
An inscription on the pillar, written in Sanskrit Brahmi script, attributes the monument to King Chandra, identified by many scholars as Chandragupta II Vikramaditya. Some theories suggest that the pillar was originally installed in Udayagiri (Madhya Pradesh) and later transported to its current location in Delhi by Anangpal Tomar, a ruler of the Tomar dynasty.
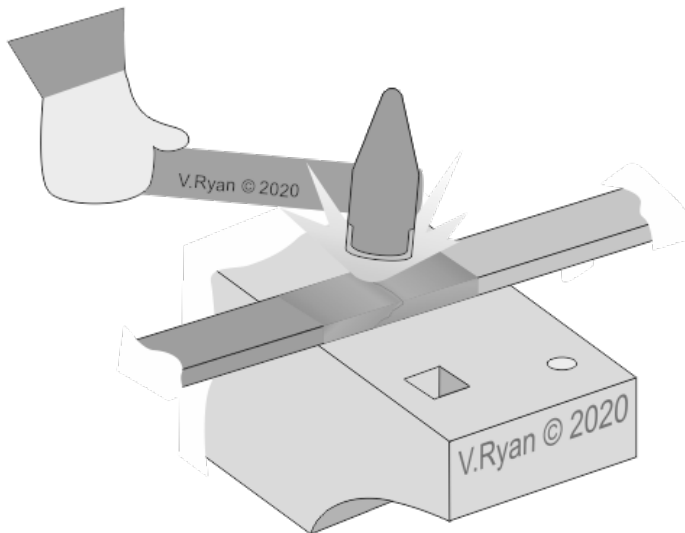
The pillar was created using a technique known as forge welding, wherein lumps of hot iron were hammer-welded together to form the massive column. This method required advanced knowledge of heat control and metallurgy. The pillar is made of wrought iron with the following approximate composition:

Iron (99%) + Phosphorus (0.05-0.25%) + Carbon (0.1%) + Sulfur and other trace elements

One of the most fascinating aspects of the Iron Pillar is its remarkable resistance to rust. It is attributed to several factors:

1. High Phosphorus Content

Unlike modern iron, which contains manganese and sulfur, the ancient Indian blacksmiths added high levels of phosphorus (0.05–0.25%), which forms a passive protective layer.

2. Iron-Slag Coating

The forging process left behind a thin layer of iron slag, which acted as a natural weather-resistant coating.

3. Formation of Misawite Layer

Over centuries, a thin protective layer called Misawite (δ-FeOOH) developed on the pillar, preventing further oxidation.

Gold Extraction Process

The process of extraction of gold has been analysed and well documented by Bharat gold mines ltd. As per this method:

A. mercury was added to the black sand and gold ore, and the mixture was rubbed with a little common salt.

B. After some time, the gold and mercury would form an amalgam. The amalgam is separated by adding water to the mixture and agitating the mixture.

C. The amalgam was rolled in a damp rag and the mercury was squeezed off.

D. Finally, it was burnt in the fire to extract the gold. If the gold was found alloyed with silver or other base metals, it was hammered into
    a. a thin sheet between two stones.

E. The plate was burnt in a two-layered cow dung. The cow dung absorbed the base metals, and the pure gold was separated. Panning method was also used for the purpose of Suvarna Bhasma, Ornaments, and Coins.
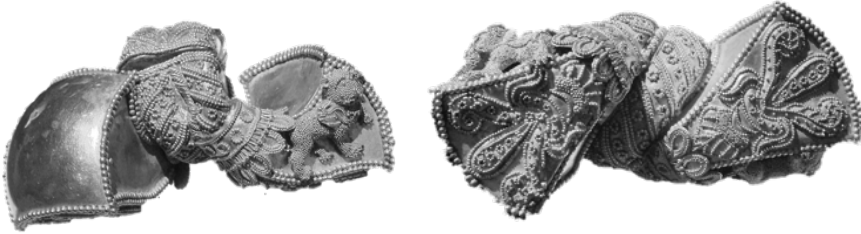
Source: https://en.m.wikipedia.org/wiki/File:Andhra_Pradesh_Royal_earrings_1st_Century_BCE.jpg

Zinc Production

Rasratnasamucchay explains about the yantra of downward drift distillation process for extraction of Zinc, Mercury. Zn has melting point, of 410° C and boiling point 930° DC. Moreover, it gets oxidized to ZnO at 550°DC. Indian solve this problem through downward drift reduction distillation process. During the process the upper pot is heated. Once it reaches 600 degree C, the

reed is burnt off and metal vapour flows downwards. The lower pot acts as a condenser, cools vapour and convert vapour into liquid metal.
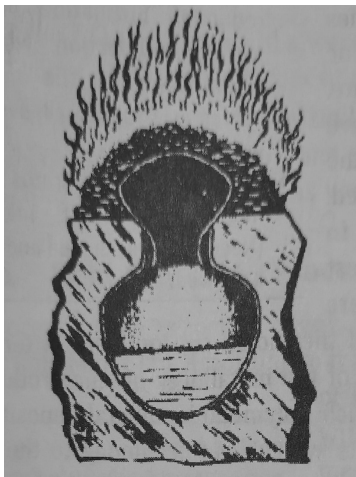
In Zawar, Udaipur it is anticipated that 15000 tonnes of zinc mined and processed here. Academicians like Hegde and Craddock concluded that India was the first to introduce this metal to rest of the world between 600 to 200 BCE. Estimates say that 250,000 tonnes of zinc concentrates extracted from 2.5 million tonnes of ore at Zawar. For mass production of Zinc they used brinjal like retorts to smelt Zinc Sulphide Ore. Two sizes of retorts have been found here, Retorts of 750 CC and 2000 CC.

Zinc retorts from Zawar zinc mines

Source:http://elearn.psgcas.ac.in/nptel/courses/video/101104065/lec38.pdf
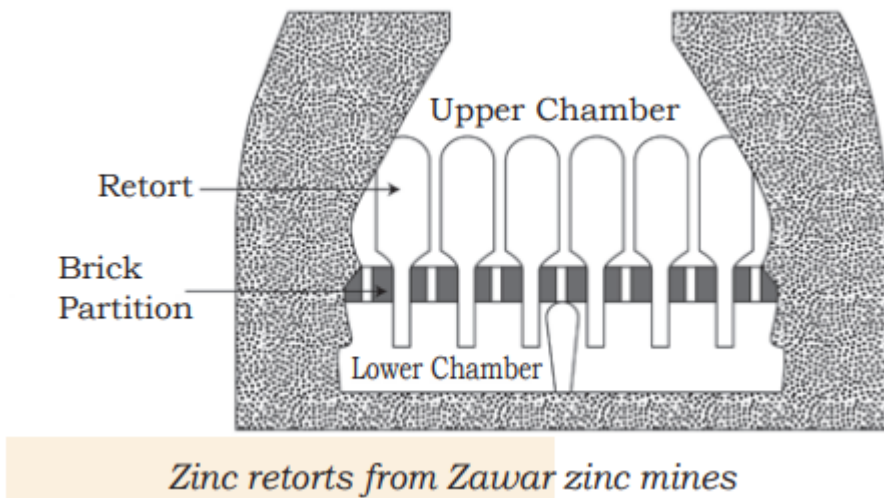
Copper for Ayurvedic Purpose

RRS talks about 2 varieties of Copper – 1) Pure red from Nepal, 2) Impure black Mlechha. Copper from Nepal is 99.5% pure and ductile whereas Mlechha has impurities of Oxides, pb, sn, as, zn, etc. Charak in his Charksamhita gives details about the importance of copper in our body what its deficiency can cause.

Iron & Steel in India

The archaeological evidences suggest that iron was used,all over India but there were no written records of manufacturing process. The ancient scriptures and legends have numerous records about the use of iron. The

process was transferred from generation to generation practically. Proper care was taken for the process not to spread out of the family. Unfortunately, this art faded out due to modern technology emerged in 19th and 20th century.

source:https://thanjavur.info/thanjavur-tourism/rajagopala-beerangi-medu-thanjavur/#google_vignette

Case Study: 3

<u>Tanjaur Cannon</u>

It is regarded as one of the largest forge-welded iron cannons in the world. Cannon was manufactured in Thanjavur during the regime of Raghunatha Nayak (1600–1645 A.D.) The entire length of the cannon is 25 feet and the rear portion is 1 foot long. The inner and outer diameters of the cannon barrel are 25 inches and 37 inches, respectively, with each ring approximately 2 inches thick. The iron rings appear to have been joined by hooping and later by forge welding.

- home.iitk.ac.in

Source: https://in.pinterest.com/pin/14847873763719310/

Dhar Iron Pillar

- Built in 12th CE – MP – by Parmar Raja Bhoj

- 3 fragments at Lat Masjid brought in 15th CE by Dilawar Khan) & 4th missing
- Structure – Square – Octagonal – Circle
- Weight – 7300 kg

Iron Smelting

- Expertise of Indians in iron owes to rich deposits of hematite, magnetite, limonite in India.

- Indian furnaces were structured with prefabricated clay blocks in such a way that they could be reused. In other part of the world they dug a hole in the earth and arranged stones for required shapes so discarded after one use.

- Tribes who smelt in India were Asuras (Karnataka), Agarias (Central India) & Lohars (tool making).

- RRS Classifies Iron in following types (RRS - 12th CE):

  1) Kanta Loha – Soft iron

  2) Tikshana Loha – High Carbon steel

  3) Munda Loha – Cast Iron

- Such type of classification is found nowhere in the world. In 1772 classification as grey, white & mottled caste iron fractures were attempted in Europe.(1772)

Extraction of Iron from Biotite By Ayurvedic Method

Sattwapatan Process of Ayurveda talks about 3 steps for smelting of Iron:

1) Shodhana (Purification)

2) Bhavana (Softening & removing impurities)

3) Damana (Heating & Smelting)

Varahmihir (550 CE) in his Brihat Samhita elaborates Carburisation method to harden iron swords.

Lost Wax Casting Process

Chola Era (11th Century) is well known for making beautiful idols & icons thorugh loat wax casting process. They made Panch Loh idols, 5 metal combination and they are Gold, silver, lead, Cu, Zn. The Oldest example of this is 6000 years old amulet IVC found at Mohenjodaro.

Dancing girl of Indus Valley Civilization

Apparatuses

Dhola Yantra
(Hunting & Liquidation)

Patan Yantra
(Sublimation or Distillation)
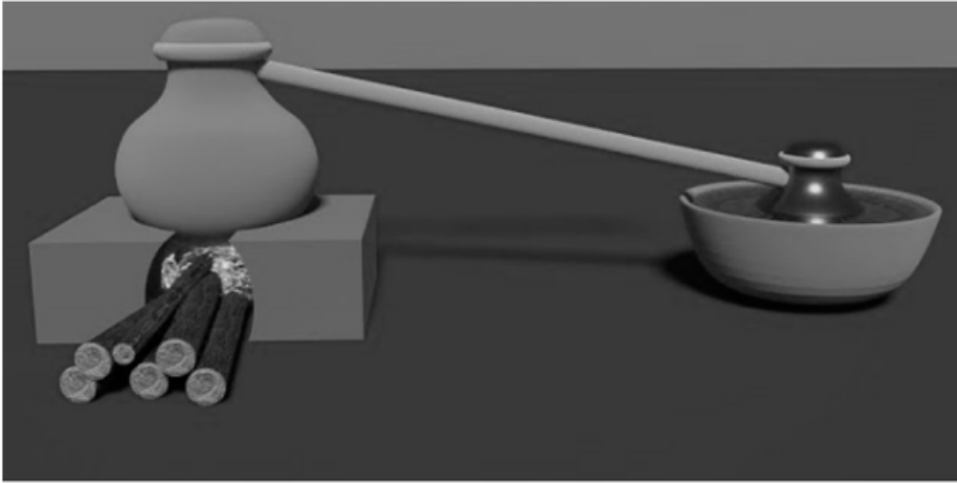
Deki Yantra
(Distillation of Mercury)

Important Ancient Indian Metallurgical Texts

Book	Writer/Author	Time
Sushrut Samhita	Sushrut	6th century BCE
Arthashastra	Kautilya	4th century BCE
Chakrapani Samita (Mercury sulphide)	Chakrapani Datta	11th century CE
Rasārṇavam	--	800 CE
Rasratnasamucchay	Vagbhat	13th century CE
Yuktikalpatru	King Bhoj	11th century CE

❋❋❋❋❋

Notes:

9.

Dhanurveda: Science of Warfare

India had a rich depository of iron and other metals. Advanced metallurgical sciences equipped India with highly advanced weapons. As a result, a great science of handling weapons, their operation, production emerged in India. India is genetically a democratic country at its root. We always respected liberty of each individual. We always prayed

<div align="center">

ॐ सर्वे भवन्तु सुखिनः। सर्वे सन्तु निरामयाः ।

सर्वे भद्राणि पश्यन्तु। मा कश्चित् दुःख भाग्भवेत् ॥

</div>

"Let all be happy and devoid of diseases. All should see goodness around and no one should get sorrows in one's life." We always have been a peaceful culture."

But the most controversial thing is, in spite of being a peace-loving culture, Indians developed a great science of warfare and weaponry. Our ancestors curated warfare skills and taught to Kshtriyas. They provide minute details about archery, wrestling, weak points of body (marmsthanani), arrangement of phalanx, vyuhas (strategic arrangements). In warfare also Indians sought ethics. They drafted the laws for fighting the battles.

A special veda has been dedicated to this science and skill called *Dhanurveda*. By name we consider it as a knowledge of archery but it is not. It's a comprehensive knowledge of warfare techniques. Its not a single book or compilation of single scholar. Dhanurveda is a collection of snippets scattered in many scriptures like Vedas, Ramayan, Mahabharat, Agnipuran, Kautilya's Arthashastra etc.

Though ancient weapons are obsolete today, Dhanurveda's principles continue to influence martial arts (like Kalaripayattu), strategic warfare, and metallurgical innovations. Many modern combat techniques still draw inspiration from the war strategies mentioned in Dhanurveda.

Dhanurveda from the Brihat Sharangdhar Paddhati, a 15th Century treatise in Sanskrit on 'The Science of the Horn Bow' by Sarngadhara. Translated from the Sanskrit edition by Peter Peterson, Bombay, 1888.

<div align="center">

न हि धनुर्वेदविदां विना युद्धं संभवति ।

</div>

<div align="right">

- *Mahabharata, Udyoga Parva 58.10*

</div>

In this chapter we will glimpse through this science.

Types of weapons

Dhanurveda categorizes weapons into four primary types:

<div align="center">

चतुष्पाच्च धनुर्वेदः सांगोपांग रहस्यकः।

</div>

<div align="right">

(नी. प्रका. 1-38)

</div>

<div align="center">

मुक्तं चैव ह्यमुक्तं च मुक्तामुक्तमतः परम् ।
मंत्रमुक्तं च चत्वारि धनुर्वेदपदानी वै ॥

</div>

<div align="right">

– (नी. प्रका. 2-11)

</div>

i) मुक्तं (Projectile Weapons) – Weapons thrown at the enemy, such as bows and arrows, spears, and discuses.

ii) अमुक्तं (Handheld Weapons) – Weapons used in direct combat, including swords, maces, and clubs.

iii) **मुक्तामुक्तं** (Hybrid Weapons) – Weapons that could be both thrown and wielded, such as the gada (mace) and certain types of spears.

iv) **यन्त्रमुक्त** (Mechanical Weapons) – Weapons propelled by mechanical means, such as catapults, ballistas, and war chariots.

Who is Acharya ?

धनुश्चक्रञ्च कुन्तश्च खड्गञ्च क्षुरिका गदा ।
सप्तमं बाहुयुद्धं स्यादेवं युध्दानि सप्तधा

- वसिष्ठ धनु.7

The person who is expert in all these battle skills is called an Acharya.

शस्त्रमस्त्रंच प्रत्यस्त्रं परमास्त्रमितीव च ।
चातुर्विध्यं धनुर्वेदे केचिदाहुर्धनुर्विदः॥

– (नीति.प्रका.)

i) **शस्त्र** – it is a weapon which held by hands.

ii) **अस्त्र** – this weapon can be released or thrown

iii) **प्रत्यस्त्र** – it is used for defense against released weapons, skills procured to defend onself from astra

iv) **परमास्त्र** – this supreme weapon is a divine weapon. As narrated in texts it was able to chase the enemy they have been aimed at.

Disciplines of Dhanurveda

The ten disciplines or parts of Dhanurveda are being elaborated as listed below-

<div align="center">

आदानमथ संधानं मोक्षणं विनिवर्तनम्।

स्थानं मुष्टिः प्रयोगश्च प्रायश्चित्तानि मंडलम्॥

रहस्यंचेति दशधा धनुर्वेदांगमिष्यते॥

</div>

<div align="right">

– (महा. आदि. 220.72)

–

</div>

1. **आदानम्** – It was used to control arrows and shooting down the enemy's arrows. Firing weapons, destroying or confiscating weapons of enemy while sitting on horse also come under this category.

2. **संधानम्** – Sandhanam means joining together. It functions like divyastra. It is said to be of 2 types: Nalika and Mantrika. Wars fought by Nalika are said to be Asur war (demonic) and Mantrika weapons are used in Daivi (divine) wars.

3. **मोक्षणम्** – Concentration of attention on the goal is 'Mokshan' and inattentive (aimless) concentration is 'Dhyaan Vimochan'.

4. **विनिवर्तनम्** – The art of recalling the weapon back after having released is called Vinivartanam. Great warriors had this capability. If they found that targeted aim is weak or defenseless they used this skill.

5. **स्थानम्** – Sthanam is an art which makes the archer able to use different parts of the bow and lock the arrows in different positions.

6. **मुष्टिः** – This is the style of using 3 or 4 fingers without thumb to throw one or multiple arrows.

7. **प्रयोग:** – Using only the index and middle fingers for the purpose of shooting. Sometimes middle finger and thumb is also used.

8. **प्रायश्चित** – In this leather gloves are used as a defensive weapon or it is called a bow attack.

9. मंडलम् – By name it suggests a circle. When the chariot moves fast in a circular motion and enemies are around you, you need to consider them stationery and attack simultaneously. Sthanam, Mushti, Prayog and Prayashchit are other strategies which can be engaged in the combat. It dominates the battlefield.

10. रहस्यं – This is a skill by which one can hit the target just by hearing the sound of the target.

Importance of Archery

दुष्टदस्युचौरादिभ्य साधुसंरक्षणं तथा ।

धर्मत: प्रजापालनं धनुर्वेदस्य प्रयोजनम ॥

एकोऽपि यत्र नगरे प्रसिद्ध: स्याद्धनुर्धर: ।

ततो यान्त्यरयो दूरान्मृगा: सिंह गृहादिव ॥

- वाशि. धनु. 1-5

The purpose of Dhanurveda is protecting the gentle and virtuous people from evils, robbers and thieves. A city or a village if dwelt by an expert archer is never attacked by the enemy. Enemies would avoid and divert from that village just like a deer usually run away after seeing the location of a lion.

Vyuhas

Source:https://hrcak.srce.hr/255341

The carvings on the *Halebidu temple* of **Mysore** that was supposed to have constructed during the 12th and 13th centuries A.D. contain a structure of **Chakravyuh**. The fact that relative spinning motion has an adverse psychological impact in diminishing mental power seems to be the foremost principle behind the design of its dynamics that finally push on an invader towards a victim of indiscriminate slaughter due to continuous multi-directional attack of strategically distributed strength of soldiers in the layers of the Chakravyuh.

Strategy has very special importance in warfare and its science. Placing the troops on various location on the battlefield to gain maximum

benefit is called strategic formation.

<div align="center">

समग्रस्य तु सैन्यस्य विन्यासः स्थानभेदतः।

स व्यूह इति विख्यातो युद्धेषु पृथिवीभुजाम् ॥ - हलायुधकोष
</div>

Presently we call it as barricade, which means positioning the army in a specific way in the battlefield. An array is very pivotal in battles and wars. An army equipped with an array, can defeat another stronger army, though it is in minority. But on the contrary, even a strong army without an array, cannot defeat a small army with an array. The names of some major arrays are as follows

i) श्येनव्यूह (Hawk) – The Syena Vyuha was only used once, by the Pandavas on Day 5.

ii) क्रौंचव्यूह (Heron) - Pandava army was arranged in this vyuha on the second day

iii) शकटव्यूह (Cart) – Drona used this formation on the 11th day for the Kauravas.

Atharvaveda talks about how to protect the army through arrays or vyuhas. Shri Rama had laid siege on Lanka by creating *Garuda Vyooha*. In the Mahabharata war, strategy formation was a common thing. Similarly, in Kautilya's *Arthashastra* and *Kamandakiya Neetisara*, the differences of many types of arrays have been mentioned, but its most authentic description has been obtained from the quotes in the texts named *Rajvijaya* within *Veeramitrodaya.*[1]

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[1] www.dharmawiki.com

	KAURAVAS	PANDAVAS
Day 1	Sarvatodanda Vyuha	Vajra Vyuha
Day 2	Garuda Vyuha	Karuncha Vyuha
Day 3	Garuda Vyuha	Ardhachandra Vyuha
Day 4	Mandala Vyuha	Sringataka Vyuha
Day 5	Makara Vyuha	Shyana Vyuha
Day 6	Krouncha Vyuha	Makara Vyuha
Day 7	Mandala Vyuha	Vajra Vyuha
Day 8	Kurma Vyuha	Trishula Vyuha
Day 9	Sarvatobhadra Vyuha	Nakshatra Vyuha
Day 10	Asura Vyuha	Deva Vyuha
Day 11	Shakata Vyuha	Krouncha Vyuha
Day 12	Garuda Vyuha	Ardhachandr Vyuha
Day 13	PADMAVYUHAM	No Vyuha on this day
Day 14	Chakrastaka Vyuha	Khadga Sarpa Vyuha
Day 15	Padam Vyuha	Varaha Vyuha
Day 16	Makara Vyuha	Ardhachandra Vyuha
Day 17	Surya Vyuha	Mahisha Vyuha
Day 18	Sarvatobhadra Vyuha	Krouncha Vyuha

War ethics

The concept of warfare in India is as old as the Vedic civilization but when we compare the ramifications of Indian wars with that of Graeco-

Romans and other civilizations of ancient times we find a remarkable contrast. In India there were laws which clearly mentioned that no civilian should be harmed in battles whereas warriors of other nations rejoiced in plundering massacaring the defeated foes. Even in Iliad of Odyssey we see that how after Greeks defeated Troy the people of the city were mercilessly killed while they were sleeping and entire city was put to flames.[2]

Types of war

Seven wars have been talked about in Vishnupuran. They are as follow:

धनुश्चक्रं च कुन्तं च खड्गश्च छुरिका गदा ।
सप्तमं बाहुयुद्धं स्यादेवं युद्धानि सप्तधा ॥

– विष्णुपु. 9

i.   **Dhanush** – wars fought by using bow and arrow (Rama, Arjun)

ii.   **Chakra** – spinning disk like Sudarshan chakra (Krishna)

iii. **Kunta** – using spears (Yudhishthir)

iv.   **Khadag** – sword (Parshuram)

v.   **Kshurika** – using knife

vi.   **Gada** – using mace (Bheem, Duryodhana)

vii. **Baahu** – (Bheem and Jarasandh)

In modern age as we divide defences army, navy, airforce ranks based on number of soldiers kept under the officers of different ranks. We also can see not same but distribution of ranking based on skills and knowledge in Dhaurveda. These ranks have given below:

- **Acharya** – Who is having knowledge about 7 types of wars.
- **Bhargava** – Who is having knowledge of 4 types of wars.
- **Yoddha** – Who is having knowledge of 2 types of wars.
- **Ganaka** - Who is having knowledge of 1 type of war.

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[2] www.isindexing.com

In this way experts of war were addressed with these titles. Nature of war is also talked about in details, Like

Divine War – started by chanting mantras

Demonic war – waged by firing by cannon guns directly

Human war – fought by handheld weapons. Handheld weapons are mentioned to be of 4 types: Divya, Naga, Manush, Rakshas

Nuances of Dhanurveda

Dhanurveda describes 10 types of arrow heads. They are as follow:

आरामुखं क्षुरप्रञ्चव गोपुच्छं चार्द्ध चन्द्रकम् ।

सूचीमुखञ्च भल्लञ्च वत्सदन्तं द्विभल्लकम्

कणिकं काकतुण्डं च तथान्यान्यप्यनेकशः ।

फलानि देशभेदेन भवन्ति बहुरूपतः ॥

Aramukha, Kshurapra, Gopuccha, Ardhachandra, Suchimukha, Bhalla, Vatsadanta, Dvibhalla, Karnika and Kakathunda. To make these arrows more deadly it also describes the process to make poison to apply at their nibs. It states the process:

पिप्पली सैन्धवं, कुष्ठं गोमूत्रेतु सुपेषयेत् ।

अनेन लेपयेच्छस्त्रं लिप्तं चाग्नौ प्रतापयेत् ॥

शिखिग्रीवानुवर्णाभं तप्तपीतं तथौषधम् ।

ततस्तु विमलं तोयं पाययेच्छस्त्रमुत्तमम् ॥

"The Peepul tree's bark along with Sindhava Lavanam (Rock Salt) and Kushta (Costus Plant) should be ground in Cow's Urine. This paste should be smeared over the arrow head and to be heated on fire until it becomes blue like a peacock neck. It should then be cooled down and washed. Such arrows when pierce into enemy's body, will have immediate poisonous effect."

Lars Anderson (Danish Archer)

- Search and study about the person who excelled in archery. He used many skills in his quest to gain mastery in archery.

Hierarchy of post of soldiers in battle of Mahabharata

Padathik – soldier on foot
12 P – Ashwarohi   Ardharathi (AR)
12 A – Gaja
12 AR – Rathi
12 R – Atirathi (ATR)
12 ATR – Maharathi (MR)
12 MR – Atimaharathi (AMR)
MR – Maha Maha Rathi (MMR)

Indian gifts to the world

Kalaripayattu

Existence of Martial arts stretches back to almost 3000 tears. It can be proved through mention of it in vedas. The popular belief says that **Parshuram**, an avatar of Lord Vishnu, is founder of martial arts in India. **Kalaripayattu**, one of the most practised martial arts of India, is believed to be innovated by Parshuram. This type of martial arts is rigorously practised in **Agasthyam Gurukulam, Kerala.** Kalaripayattu is probably the oldest form of martial arts in India. The word kalaripayattu is a combination of two words, namely, 'kalari' and 'payattu' which mean training ground and fight.

立其弟子像。周恩来总理有诗曰：大江歌罢掉头东，邃密群科济
世穷，面壁十年图破壁，难酬蹈海亦英雄。

Dharma Cave

Bodhi Dharma, a famous monk from India, stayed in the cave for 9 years in meditation and brought about Zen Buddhism. The stone archway in front of the cave was built in the 32nd year of Wanli in the Ming Dynasty (1604 A.D.). The stone statue of Dharma is enshrined inside the Cave with his disciples standing on both sides.

Bodhi Dharma
Creator of Shaolin Kung Fu

Bodhidharma, at the monastery of Shaolin, saw that the monks were weak from meditation and fasting. He meditated, practised and innovated new technique of martial arts gave lessons to monks similar to **Kalaripayattu**! This gave birth to the famous kung-fu warrior monks of **Shaolin**!

Types of forts and their construction

Forts have played very pivotal role in building any empire of the world. In India right from the time of Kautilya we find the traces of building forts. Before that in vedic literature we find some threads of it. These architectural marvels stand as testimony of ancient military prowess and intelligence. Girivrijja, the first capital of Magadha, was constructed very strategically where 3 sides of place were fortified by mountains and front side was protected by a wall. In earlier days, rulers ensured that their capital was fortified either naturally by mountainous paths, rivers, dense forests or artificially constructed ramparts or growing thorny plants.

Today, though forts merely stand as memorial of our history, culture

and heritage still it significantly imparts us with insights into strategic warfare, fort making techniques, metal alloys and other material used in it and civil engineering of that time. They are eyewitness how particular region overcame the climate of their area using locally available material and innovative ideas. Stepwells and water canals at Hampi stand as testimony to the methods of water conservation and irrigation adopted within the citadels of rajas and maharajas of ancient days.

यत्पुरं दुर्गसम्पन्नं धान्यायुधसमन्वितम् ।
दृढप्राकारपरिखं हस्त्यश्वरथसङ्कुलम् ॥
विद्वांसः शिल्पिनो यत्र निचयाश्च सुसञ्चिताः ।
धार्मिकश्च जनो यत्र दाक्ष्यमुत्तममास्थितः ॥

– Maha. Shan. 12.86.6 & 7

Summary: In this shloka of Mahabharat, Bhishma describes the types of forts for king to inhabit. According to him, the king should reside in a fort or city which has following features:

- It should be surrounded by gates and fortification.
- Natural or manmande fortification
- Full with granary and weapons
- Having filled with treasures
- having elephants, horses, chariots, vidvat jana (learned people), shilpakaras (skilled people)
- having dharmik people and experts of all kinds of activities
- places of trade, exchange of goods and essentials
- granaries for storing various kinds of grains
- places of worship
- separate housing facilities for people supporting the administration
- garrison for large number of trained soldiers, horses and elephants
- weapons, fire-implements, yantras or machines for protection
- having a strong judicial system

- having place of music and arts

एकः शतं योधयति प्राकारस्थो धनुर्धरः ।
शतं दशसहस्राणि तस्मादुर्गं विधीयते ॥

<div align="right">- Manu. Smrt. 7.74</div>

Fort stands as an exceptional way of defence; 1 archer can easily withstand 100 archers by standing behind the walls of forts and 100 archers can stop 1000 archers. This is strength of a fort.

Mahabharata Shantiparva also provides ample information about forts and warfare. According to Bhishma, a fort surrounded by a huge wall and a ditch full of water, furnished with only one entrance is the best.[3]

आवासस्तोयवान्दुर्गं एकमार्गः प्रशस्यते ॥

<div align="right">- Maha. Shan. 12.100.15</div>

Kinds of Forts

षड्विधं दुर्गमास्थाय पुराण्यथ निवेशयेत् ।
सर्वसम्पत्प्रधानं यद्वाहुल्यं चापि सम्भवेत् ॥
धन्वदुर्गं महीदुर्गं गिरिदुर्गं तथैव च ।
मनुष्यदुर्गं अब्दुर्गं वनदुर्गं च तानि षट् ॥

<div align="right">- Maha. Shan. 12.86.4 & 5</div>

<div align="right">-</div>

1. **Dhanvadurga**: It is also called Marudurga. It is covered with sand on all sides.
2. **Mahidurga**: This fort is constructed underground in a plain area.
3. **Giridurga**: Giri means a hill. These forts are built on the hills, surrounded by mountain ranges.
4. **Manushyadurga**: A shield like fort made up by soldiers.
5. **Abdurga**: A fort surrounded by water from all sides.
6. **Vanadurga**: A fort in the midst of thick forest area

Yantras in a Fort

There were a variety of weapons housed inside the fort to attack enemy and defend the fort. There are basically two types of such instruments. One is Sthira (Steady or fixed) and the other Chala (Moving). Arthashastra mentions a number of weapons:

सर्वतोभद्रजामदग्न्यबहुमुखविश्वासघातिसङ्घातीयानकपर्जन्यकबाहूर्ध्वबाह्वर्ध्वबाहूनि स्थितयन्त्राणि । पाञ्चालिकदेवदण्डसूकरिका मुसलयष्टिहस्तिवारक तालवृन्तमुद्ग्रर गदास्पृक्तलाकुद्दालास्फोटिमोत्पाटिमोद्घाटिमशतघ्नि त्रिशूलचक्राणि चलयन्त्राणि ।

- Arth. Shas. 2.18.5 & 6

a) Types of Sthirayantras (स्थिरयन्त्रम्)

- Sarvatobhadra (सर्वतोभद्रः) A Sharp-edged wheel placed on wall that is rotated to fling stones.
- Jamadagnya (जमदग्नीययन्त्रम्) It's a mechanical machine used to throw arrows through crevices in the wall
- Bahumukha (बहुमुखः) It's a leather-covered mount to enable archers to shoot all around.
- Vishvasaghati (विश्वासघाती) It kills people as it falls and pounds them

b) Types of Chalayantras (चलयन्त्रम्)

- Pancalika (पाञ्चालिका): This weapon has sharp protruding points and is thrown into the water.
- Devadanda (देवदण्डः): Shape of it is cylindrical. It functions like cannon and kept at parapet of walls.
- Sukarika (सूकरिका): It is huge, creates obstruction on the path and when suspended on the walls prevents scaling by the enemies. Not only this, it also acts as a buffer when enemies fling stones.

Siege of fort

उपजापोऽपसर्पो वा वमनं पर्युपासनम् ।
अवमर्दश्च पञ्चैते दुर्गलम्भस्य हेतवः ॥

(Arth. Shas. 13.4.63)

Kautilya, in Arthashastra, talks about 5 techniques to lay down the siege around the fort.

i. **Upajapa (उपजापः)** - A messenger speaks high of the king, his omniscience and tries to create sense of awe towards him in the enemy. (About Shivaji maharaj it was said that he had the power to disappear and he is bestowed from Bhavani Mata. These rumours Shivaji Maharaj never denied, though he knew it.)

ii. **Yogavamanam (योगवामनम्)** – Using weakness of the king to kill or abduct him. (Shivaji Maharaj and Shayistekhan)

iii. **Apasarpapranidhi (अपसर्पणप्रणिधिः)** – Quarrel with own king and friendship with enemy (conflict with Netaji Palkar)

iv. **Paryupasanakarma (पर्युपासनकर्म)** – Process in which water filled in moats

v. **Avamarda (अवमर्दः)** Storming of the Fort (Capturing Panhala after the death of Afzalkhan)

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Notes:

10.

India & its impact on South East Asia

Influence of Indian Vaastu shastra on South East Asian Temple Architecture
(with special reference to Angkor Wat Temple)

Introduction

Indian policy To look East and Act East is nothing but déjà vu for Indians. There has been a long string of India's relations with South East Asian (SEA) countries. The voyage which started with a trade of spices, turned out to be the transfer of culture from India to SEA. This transformation was never of despotic nature but emerged out of amiable and comfortable values of Indians.

Maritime connection of India with South East Asian countries dates back to Christian era. Trade relations with this archipelago existed from Ramayan period as the names of Java and Sumatra have been found at many places with different Sanskrit names. The *Ramayana, Pali Nidesa* and other classical texts include descriptors such as "land of gold" (*suvarnadvipa*), "island of gold" (*suvarnabhumi*), "island of coconuts" (*narikeladvipa*), "island of camphor" (*karpuradvipa*) and "island of barley" (*yavadvipa*).

Stories from Ramayana have become an integral part of SEA literature, art and culture. Buddhist Jataka stories are full of seamen who are migrating from India to Suvarndweep for Educational as well as trading purposes. Itsing

before coming to India learnt Sanskrit Grammar on this island. He spent almost six months there, which is testimony of influential Mahayan Buddhism's existence on the island.

As per Chinese sources, Funan empire, presursor of Combodia, was founded by Brahmin – Kaundinya first century AD. Gold medals of Roman King Antoninus Pious of AD 152 together with sanskrit text seals of same period have been found at OC EO, the port of present Vietnam southern border.

The transition period of BC to AD had witnessed the emmergence of super powers in the form of Mauryas and Kushanas in the East whereas Roman and Selucid in the west. They traded luxury articles like gold, sandalwood, perfumed resins and spices amongst them. But as a interruption to this Roman emperor Vespasian (69-79 AD) stopped export of metals and India was forced to seek it in Suvarndeep.

The Periplus of the Earythrian Sea mentions three ancient maritime seaports, namely, Kaveripatnam, Pondicherry and Markanum. Tamralipti (Tamluk) is another and the widely used one port as described by Fa Hien (5th century AD) & Itsing (7th century AD) who initiated their journey from India to Sumatra and then to China from this port. Chilika zeal, one of the largest salty lake, was in use as defender of seafaring vassals during high tides. Riding over the Retreating Monsoon indian seamen would reach Srivijaya empire and made their retreating journey on the back of Arriving Monsoon in India.

Canggal Inscription, an edict raised by sanjaya (Shailendra dynasty), was discovered in 732 AD in Gunung Wukir temple complex. The inscription describes the erection of a <u>lingam</u> (the symbol of <u>Shiva</u>) in the country of Kunjarakunja, by Sanjaya's order. King Shailendra to King Sanjay Suvarndwip was infuenced by Hinduism but after the adoption of Buddhism by Rakai Panangkaran, Mahayan Buddhism was patronised and as a beginning of this he built Kalasan Buddist temple.
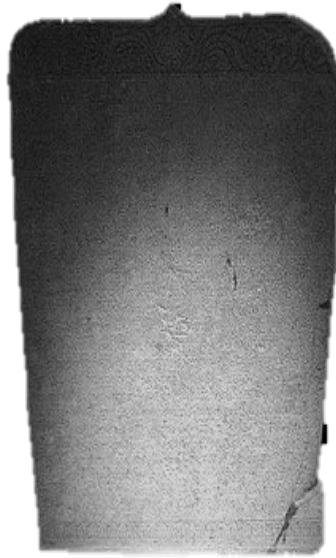
Canggal inscription

Kalasan Buddhist Temple, Java

Dharanindra (775-800 AD) expanded the empire and brought Mataram (Java), Sriviijay (Sumatra), Kamboj (Combodia) and Champa (Vietnam) empire under one roof of Shailendra dynasty. Under his patronage construction of Borobudur was initiated which took 55 years for its

completion and complete during the reign of *Samartunga* in 825 AD. After minor developments in the empire Srivijaya empire was conquered by *Rajendra Chola* in 1025 AD.

From all these short glimpses of history the influence of Indian culture on SEA countries is very evident. From *Funan empire,* with the continuous series of Khmer, Srivijay, Mataram, Champa, Majapahit and other empires, the influence of Indian culture flouished in this region. Art, culture, literature, history and sciences of India have been interwoven with this civilisation.

This chapter is to focus on architectural relations of India with South East Asian countries. It is an honest effort to understand the structure, civil technology, aesthetic values of Mahayan Buddhist temples and Hindu temples built on this archipelago. Transfer of material knowledge between Indian subcontinent and this archipelago will also be one of the major issue in this article.

Case Study - Angkor Wat

Source: https://awardpremiervacations.com/vacations-ultimate-bucketlist-4days-temples-of-angkor.html

Introduction

In 1860, a French naturalist Henry Mohout, in search of exotic insects, while cutting the branches came across a 900 old massive stone complex whose first appreance to him was giving testimony of great grandeur of Combodian Khmer Empire. This massive structure of Angkor Wat attarcted

the sight of world historians and archelogists whose further investigations through satellite images revealed that the Angkor wat just a part of a great sophisticated civilisation of Angkor, whose size resembled with Modern London City.

History

The City of Angkor (ancient Name : Yasodharapura) once the capital of one of the largest empire in the history of South East Asia from where Khmer kings ruled. According to an inscription in the *Sdok Kok Thom temple*, In 790 Jayvarman II, a Khmer Prince, became king of a kingdom called Kambuja by the Khmer. He then moved his court northwest to *Mahendraparvat*a and according to Hindu rituals he bore traditional titles *Chakravartin* and *Devaraja.*

After 3 kings in series, Yashovarman I, established a new capital, Yasodharapura - the first city of the larger Angkor area. During Suryavarman II, construction of Angkor wat was completed which took 37 years from 1113 to 1150. It was the reign of Suryavarman II during which Chola King Rajendra I, allied with Khmer, attacked Srivijay and Tamralinga empires.

Angkorean Architecture and Construction

The Angkor Wat temple's main tower aligns to the morning sun of the spring equinox. Orientation of Ankor Wat is towards West rather than East about which many historians conclude the utility of temple serves funerary purposes. But as per notes of others, westward orientation represents vaishnavite impact as Vishnu is associated with the west.

With increasing influence of vishnu in India, Suryavarman II dedicated this temple to Vishnu instead of Shiva. Bas reliefs depict Vishna battling with against asura opponents, or riding on the shoulders of his vahana or mount, the gigantic bird-man Garuda. Vishnu's attributes include the discus, the conch shell, the baton, and the orb.

Layout details

The sandstone used in Ankor wat construction, carried to the building point on rafts through *Siem Reap* River from holy mountain of *Phenom Kulen*, 50 kilometers away. Construction involved 300,000 workers and 6000 elephants s per inscriptions.

Rectangular outer wall around Angkor Wat measures 1025m by 800m, has gate on each side, but main entrance measures 235m wide on the western side. The stairs to upper level are immensely steep because reaching the kingdom of Gods was no easy task.

The design of the temple is supposed to represent 'Mount Meru' which is known as the home of the gods according to both the Hindu and Buddhist faiths. There are five main towers that symbolize the five great peaks, and everything underneath them is adorned with the spiritual foundations of these great religions.

Source:https://utkalpratidin.in/angkor-wat-became-the-8th-wonder-of-the-world-lets-know-about-it/

Decline

Angkor Wat was rededicated as a Buddhist temple in the 14th century CE and statues of the Buddha and Buddha-related stories were added to the lready impressive iconography. As the Buddhists respected the beliefs of the Hindus who still worshipped there, all of the original statuary and artwork was left in place. The Buddhist craftsmen added to the intricate story of the temple while taking nothing away.

By the early 16th century CE, use of the temple had waned, even though it was still occupied by Buddhist monks, and it became the subject of stories and legends. It was said to have been built by the gods in the distant past and a popular story emerged that the god Indra had built it as a palace for his son and that it rose from nothing in the course of a single night.[3]

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[3] www.ancient.eu

Notes:

11.

Architecture

Introduction

Architecture can be defined as a field of art which deals with the construction of a building, palace, temples which are designed by human beings. So it very vivid to understand that these architectural marvels stand as testimony of those empires' grandeur. Richness of any civilization or an empire is always measured by these buildings left behind. Architecture, Vastuvidya of ancient India is as old as the Vedas that belong to the period 1500 to 1000 BCE. By the 1st century CE this science was completely developed technically. Most of the literature though lost, some rituals are connected with this science known as Vastushastra. Its compilation continued till the 15th century CE and even today the part of the construction process goes on.

According to the Indian tradition, there are many Gods having natural superpowers who give benefits and pose threats also. Gods related to water, air, fire, river, mountains are representation of human gratitude towards nature. These forms of god are considered to have spirit and soul with power. Therefore, new science of iconography developed in India where devotees

designed and carved statues in temples to worship them as if the statues are alive and conscious.

Vastuvidya or shilpashastra (architecture) is one of the technical subjects studied in ancient India. In the earliest texts, the word vastu is used for building which included temple construction, town planning, public and private buildings, and later on forts.

Atharvaveda too has references to different parts of a building. Kautilya's Arthashastra deals with town planning, fortifications and other civil structures. Samaranganasutradhara, authored by *King Bhoja* (1010–55 CE), discusses the methods of examination of a site, analysis of the soil, systems of measurement, qualifications of the sthapati (main architect) and his assistants, building materials, consecration of the plan followed by the construction of foundation, basal mouldings and technical details for each part of the plan, design and elevation. Mayamata (1000 C.E.) and Manasara (1300 C.E.), are the two texts having common understanding of the architectural plans and design of the southern style of temple architecture known as Dravida.

Six limbs of Painting or Sculpture

Vatsyayan in his Kamasutra, (second century C.E.) describes the shadang or six limbs or elements of painting as:

1. Rupabheda – Difference of appearance
2. Pramana – Proper proportion, measure and form
3. Bhava – Emotions and feelings expressed through
4. Lavanya yojana – Infusion of artistic expression
5. Sadrushyam – Similarities between real one and sculpture
6. Varnikabhanga - Analysis of colour and hue

Characteristics and Elements in the Architecture of India

a) Vastu Purusha Mandala: Detailed Explanation

Source:https://www.vaastu-shastra.com/latest-articles.html
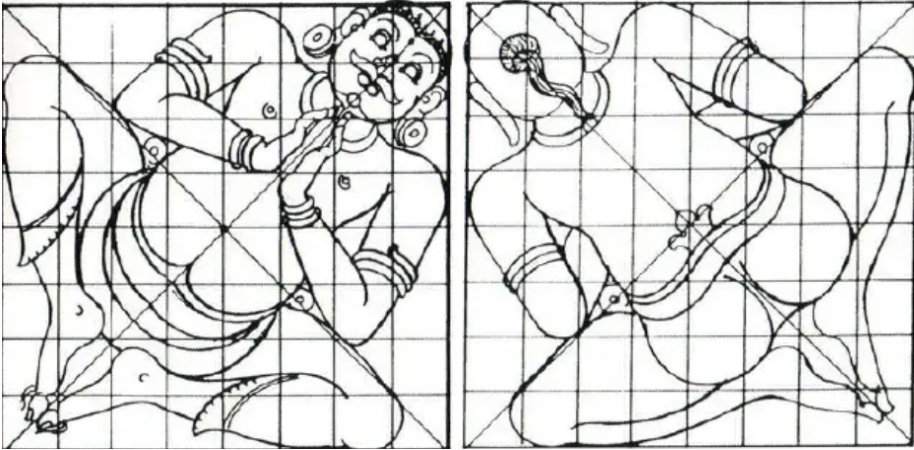
## Mythological Story Behind Vaastupurusha

Brahma, the supreme creator of cosmos created the cosmic man 'Vaastu Purusha' while germinating the life in the universe. Vaastu Purusha has an insatiable appetite and began devouring whatever caught his attention and grew so large in a short span of time. His shadow eclipsed the planet permanently. The task to stop the Purusha was so difficult that it took 45 gods including Brahma, to pin down Vaastu Purusha face down on the earth, before this creature annihilate the universe. Brahma held him in the middle whereas other gods grabbed its different limbs. His head was pointing to the north-east, legs towards the south-west. Out of 45 gods holding down Vaastu Purusha, 13 are in the interior sides and 32 are in the peripheral sides.

45 energy fields are represented by these 45 gods and have certain inherent qualities. In the diagram we can observe how the Vaastu Purusha has been pinned down on the earth facing head down. It was a collective effort of 45 Gods (including *Brahma*) to pin *Vastu Purusha* down.

As we can see Vaastu Purusha Mandal is divided into 9×9= 81 parts and each part names the God holding Vaastu Purusha down in respective part. Presence of 45 gods in mandala they influence and rule different parts of a human life as per their qualities. This is the reason while making any room we take care that the god of that area not to be offended. Vaastu shastra lays down guidelines to keep gods happy to have happiness in our life. Hence as per *vastu shastra* if any building is constructed as per *Vastu Purusha Mandala* then prosperity prevails in the building and inhabitants are always happy, healthy, wealthy and satisfied.

As humans, depending upon the time, we perform many functions throughout a day. For example, we sleep at night, get-up in the morning, work in daytime and again go to sleep at night. Also, we perform all these activities at different locations in a home or any other building, such as office, workshop etc. As we are aware that the earth takes 24 hours to rotate around its own axis and due to this movement of the earth position of sunrays falling on the earth keep bending continuously.

Depending upon the position of the Sun in relation to earth during a 24 hour period, Vastushastra structures various rooms of a home in such a way so that during anytime in a day, depending upon the location of work, humans get the best rays of sun on them.[4]

Eight Limbs of Vastu
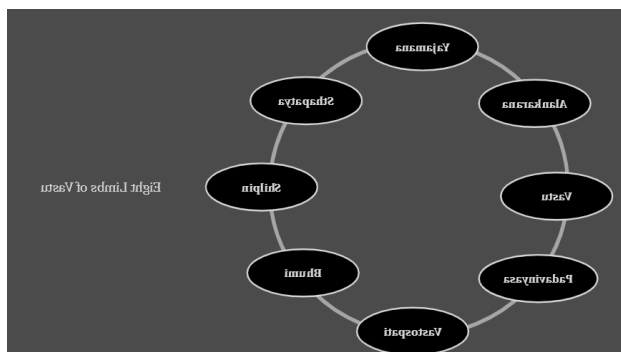

Location of Rooms

Let's understand the importance of location of rooms based on direction: -

1. North East: 3 to 6 am, the sun is in the North-East part of house. This is called as *Brahma Muhurta* and best for meditation, yoga, study or pooja.

2. East: 6 to 9 am, the shines in the east part of home. This time being very best to be prepared for the day, east part of house is suitable for bathroom (not toilet).

3. South East: 9 am to 12 pm, this time is best for preparing food and going to job. So, it is the best place for kitchen, office or unmarried son's bedroom.

4. South: 12 to 3 pm, is a time to work. So southern portion of a building is good for office. In this portion sunlight is very hot so it also can be utilised as a store room, staircase and even toilets.

5. South West: 3 to 6 pm, Post lunch is the time to rest. So, this location best for master bedroom.

6. West: 6 to 9 pm, is best time relax and dine. So best location for dining room.

7. North West: 9 pm to 12 am, is time for relaxation so suitable for bedroom and living room.

8. North: 12 to 3 am, is a time of secrecy and darkness, so safe for cash can be installed in this area.[5]

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[5]

Urban Planning in India

A schematic representation of Chanakya's plan for a fortified city
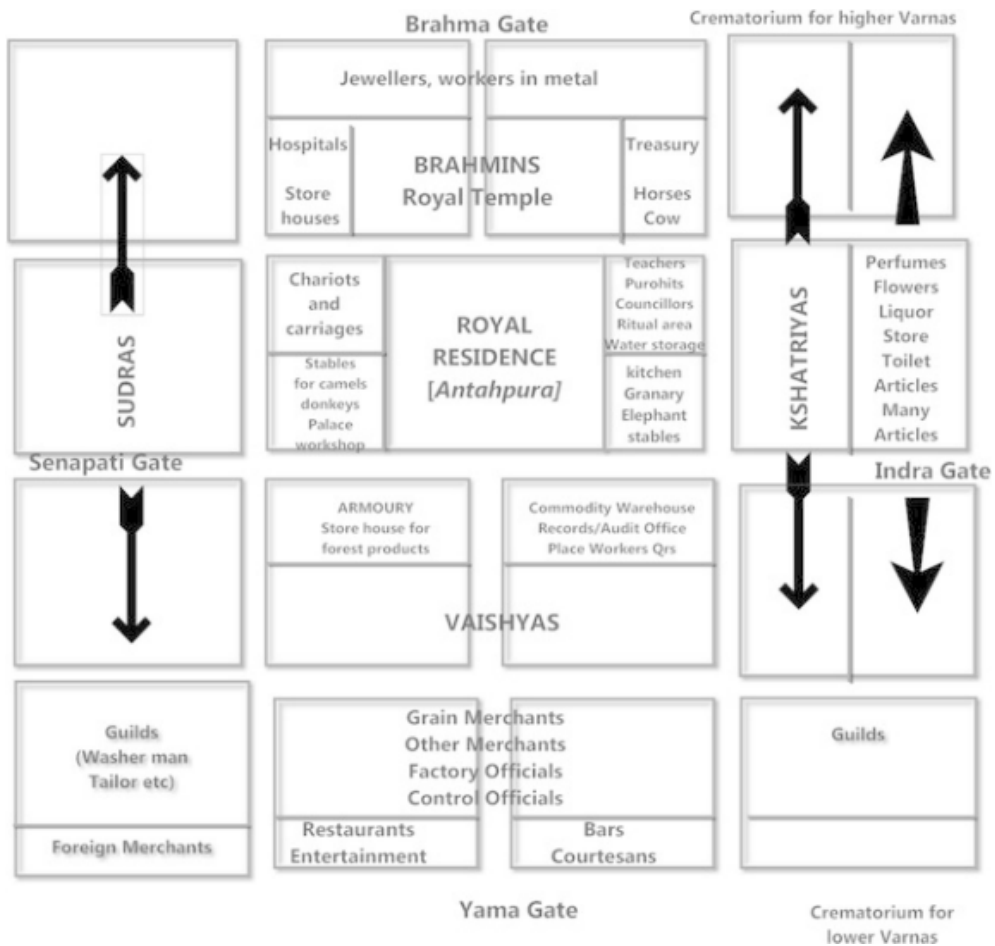
Source:https://www.researchgate.net/figure/The-fortified-Mauryan-city-Source-Rangarajan-1992-p-165_fig4_305744284

Architectural Acumen of Kautilya

The above image depicts the architectural and integral acumen of Kautilya. He has planned the structure of a city in very elegant way. Seeing the utility of every individual group of society he has assigned a specific place for their residence in society. The royal palace is in the middle of the city and protected from all sides. Direct attack on the palace is not possible in this structure. City has been divided into

12 main blocks.

Types of Cities

Based on various structural aspect *vastushastra of Mansara* has categorised towns in following categories:

Different Categories of Towns in Vastu Texts		
Rajdhani Sabha at centre	**Karvatika** Among 200 villages
Putabhedana 2nd home of king	**Kheta** Labour class town
Dronamukha On riverbank	**Nigama** Market of artisans
Durga Fort town-12 types	**Grama** Smaller than Nigama
Sthaniya Fort among 800 villages	**Maths/Vihara** Residential University
Shakhanagar Subsidiary town	

Dandaka
Meant for spending life in Vanaprastha – smallest of all

Sarvatobhadra
Safe from all sides – Ex. Chandigarh

Karmuka
Bow formation – at seashore – Ex. Poomphar, Kaveripattnama

Prastara
Couch or bed – Ex. Jaipur

Some of the Categories of Towns in Manasara

Temple Architecture

Temples are generally seen as the place of worship and religious shrines. But if you observe them carefully, they are the testimony of Indian architectural marvels. It includes functions of designing, architecture, civil engineering, supply chain, logistics and sense of color tones.

Though they are visited as a spiritual place to gain peace of mind and serenity but architectural perspective also can be a reason to visit such place. Lets try to understand few among them:

Temple architecture of India can be broadly divided into two styles:

a) Nagara Style   b) Dravida Style

a) **Nagara Style** of Indian Temple in North India, it is common for an entire temple to be built on a stone platform with steps leading up to it. While the earliest temples had just one shikhara with garbhagriha located directly under it, later temples had several shikhara. Konark, Khajuraho, Dashavtar temple are some of well-known Nagara style temples.

Source:https://en.wikipedia.org/wiki/Antarala
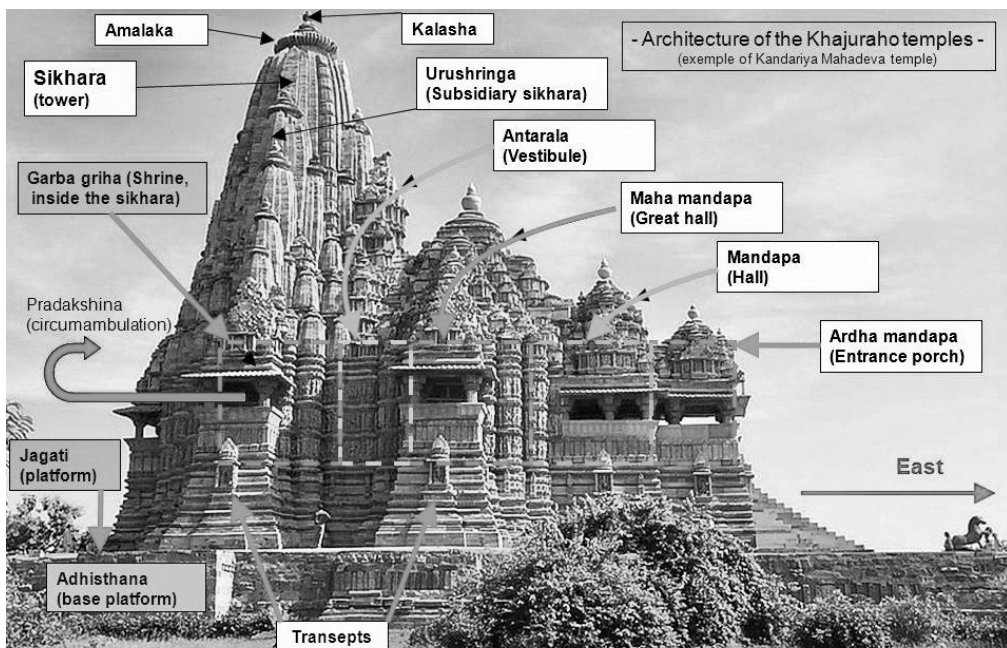
Based on the above picture there are some elements that are on a temple namely:

    a. **Garbhagriha** – sanctum sanatorium - sacred space contained main deity

    b. **Vimana** - tower appearing above the roof Garbha Griha.

    c. **Mandapa** – forefront of the temple, a hall of worship.

    d. **Sikhara** - The roof has a crown's.

    e. **Kalash** – It is an apex of the temple.

b)   **Dravidian style** temples are characterized by their pyramidal towers, large entrance gateways, and intricate carvings. Its features are:

    a. **Garbhgriha** – Sanctum sanctorum

    b. **Vimana** - A pyramidal tower that rises above the garbhagriha

    c. **Gopuram** - The entrance gateway that leads into the temple complex

    d. **Pillared halls** - Used for worship and other religious activities

    e. **Dwarpalas** – statues of ferocious doorkeepers that defend the temple at the garbhgriha's entrance

    f. **Mandapa** – A pillared well that separates the garbhagriha and the vimana
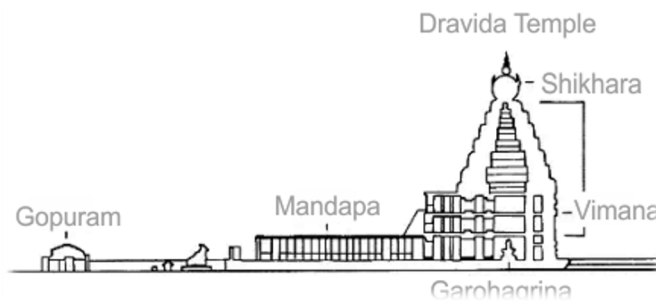
Source:https://testbook.com/ias-preparation/dravida-architecture

Temples as architectural marvels, a Case study:
Wonders of Brihadeshwar Temple

1. At noon, the Vimana's shadow never falls on the ground. This is because the tower is built perpendicular to the earth with not even a single degree of inclination, and findings also indicate that the base is much larger than the Vimanam.

2. The stone used to create the main deity, Lord Shiva, was brought from Saurashtra in Gujarat in West India. The astounding fact here is that the distance between Tanjore and Gujarat is 2100 kilometres. It is surprising how it was possible 1000 years ago with no transportation technologies. It remains a mystery till date.

3. It is well known that the temple is entirely made of granite. A staggering 1,30,000 tonnes of granite were used in the construction, but there is no trace of any granite quarry within a 50-kilometer radius.

4. No binding material was used to connect the rocks; instead, interlocking stones were used to construct this 216-foot-tall structure. Until now, the brilliance of architecture has not been matched by our modern.

5. Perhaps the most baffling aspect of the *Brihadeshwara Temple* is its mammoth dome, weighing a staggering 80 tons. Constructed entirely of granite and devoid of any modern engineering tools, this architectural marvel defies gravity.

Source:https://economictimes.indiatimes.com/news/india/6-famous-temples-you-must-visit-in-tamil-

nadu/ramanathaswamy-temple-rameswaram/slideshow/115931048.cms?from=mdr

Some important treatises, or books with chapters on Vaastu Shastra include:

a. Manasara

b. Brhat samhita

c. Mayamata

d. Anka sastra

e. Aparajita Vastu Shastra

f. Maha-agamas

g. Ayadi Lakshana

h. Aramadi Pratishtha Paddhati

i. Kasyapiya

j. Kupadi Jala Sthana Lakshana

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## Notes:

12.

Ayurveda

Definition of Health and Ayurveda

Ayurveda is a whole-body (holistic) system of medicine that began in India more than 3,000 years ago. Ayurveda means the study of life. It takes a natural approach to all aspects of health and well-being.

The sensory and motor organs, sense organs, mind, and Soul must be also in a pleasant state. Such a person is, who is balanced in all those areas, is called a healthy person or Swastha.

समदोषः समाग्निश्च समधातुमलक्रियः ।
प्रसन्नात्मेन्द्रियमनाः स्वास्थ्यं इत्यभिधीयते ॥

<div align="right">–   सुश्रुत संहिता, सूत्रस्थान 15.41</div>
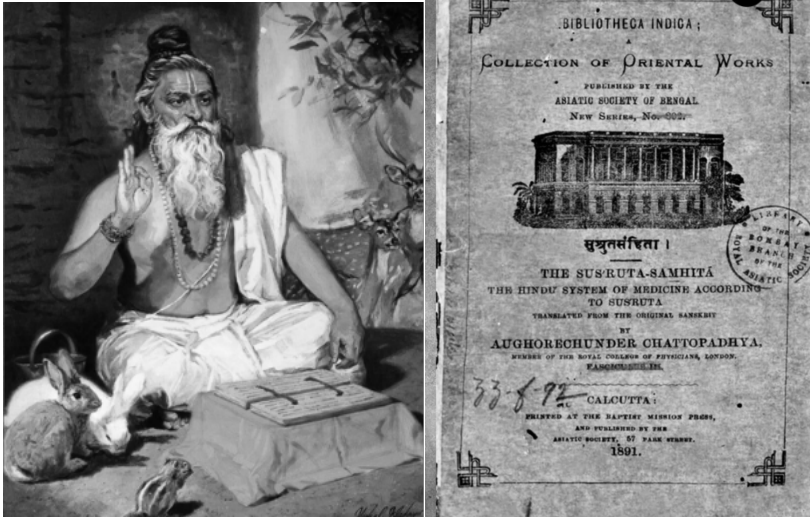
2. Tridoshas

Ayurveda believes that the entire universe is composed of five elements: *Vayu* (Air), *Jala* (Water), *Aakash* (Space or ether), *Prithvi* (Earth) and *Teja* (Fire). These five elements (referred to as *Pancha Mahabhoota* in Ayurveda) are believed to form the three basic humors of human body in varying combinations. The three humors; *Vata dosha*, *Pitta dosha* and *Kapha dosha* are collectively called as "*Tridoshas*" and they control the basic physiological functions of the body along with five sub-doshas for each of the principal doshas.

3. Seven substances

Ayurveda states that the human body consists of *Saptadhatus* (seven issues)

1. *Rasa* (tissue fluids)
2. *Meda* (fat)
3. Rakta (blood)
4. Asthi (bones)
5. Majja (marrow)
6. Mamsa (muscle)
7. Shukra (semen)

As we eat food it gets converted into different body parts giving energy to function. Digested food transforms itself in above given seven tissues. Ayurveda also minutely describes the process of food digestion in our body. The image given below picturises this process.
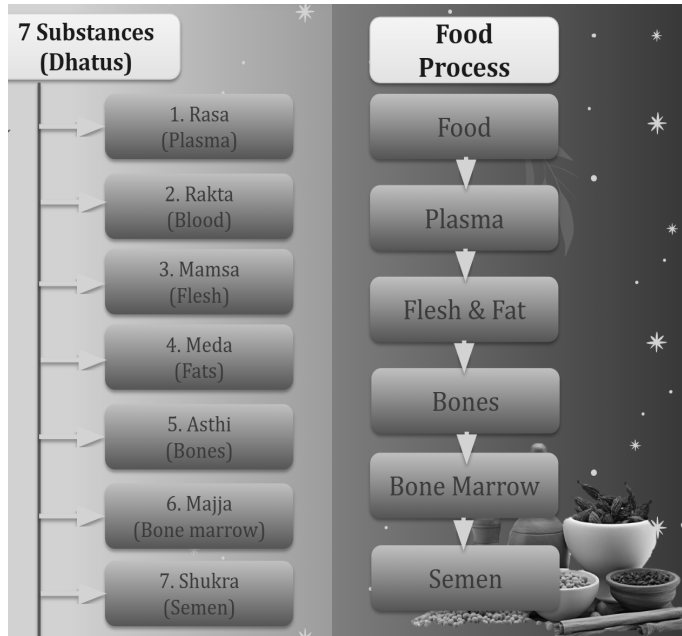

Fig.8.1 – Process of food conversion from plasma to Shukra

Dincharya

Ayurveda gives a detailed schedule of day to leave healthy life. Here is a schedule of common person throughout the day.

a. प्रतारउत्थान – Waking up in Brahma Muhurtha that is last yama of night. It gives nascent oxygen in the atmosphere readily mixes up with hemoglobin to form oxy-hemoglobin which nourishes the remote tissues rapidly.

b. उषा जलपान - 1-2 glasses of water kept for whole night should be taken before sunrise.

c. शौचविधि - at proper time clears the rectum, increases digestive power, and prevents constipation, foul smelling flatus.

d. आचमन - To prevent eye diseases.

e. **दन्तधावन** – It stimulates taste perception and increases the salivation. · salivary amylase-protects teeth from bacterial decay.

f. **जिव्हा निर्लेखन** – to acupressure theory, it initiate the proper functioning of liver, kidney, bladder, stomach, intestine.

g. **स्नेहगण्डुष धारण** – improves the circulation of oral cavity. Massaging effect over the oral mucosa

h. **अंजन** – eyes become beautiful, capable of seeing even minute objects, prevents dry eye or computer vision syndrome.

i. **नास्य** – avoids the entry of dust particles into the nasal tract. Triggers the nerve endings and sends the message to the CNS.

j. **धूमपान** – Stimulate the respiratory centre present in brain stem ,it triggers the normal physiological function of respiratory system.

k. **व्यायाम** – Increases the carbohydrate metabolism and causes lipolysis of accumulated adipose tissue, causing abolishment of extra fat. It increases O2 supply to remote tissues. The perspiration takes out the accumulated toxins from the body.

l. **चंक्रमन** – It clears the srotas of the body and increases the perceptive power of organs.

m. **अभ्यंग** – Enhances blood circulation and transport the potency of drugs to desired part.

n. **स्नान** – Improves enthusiasm, strength, appetite and removes sweat and other impurities from the body.

o. **संध्योपासना** – worshiping of god

p. **भोजन** – Satmaya Aahara with pleasant mind. Ushna Jala Pana has been mentioned for proper digestion of food.

q. **ताम्बूल सेवन** – Stimulates the taste bud, Increases salivation, scraps the deposited matter.

r. **निद्रा** – Essential for growth, strength and longevity of life

Hippocrates: humoral theory
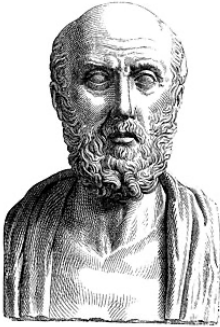
- **Emphasize the importance of lifestyle factors like diet, exercise, and mental well-being to maintain health and balance these humors/doshas.**
- **medical system that developed in Greece around 300 BCE.**

Ayurveda: Doshas
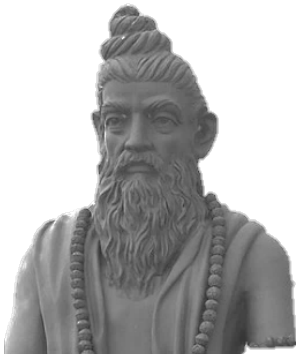
- **Emphasize the importance of lifestyle factors like diet, exercise, and mental well-being to maintain health and balance these humors/doshas.**
- **Ayurveda developed around 3rd – 4th century BCE.**

Western Medical developments & Ayurvedic methods

Circadian rhythm

The 2017 Nobel Prize in Medicine was awarded to elucidation of the molecular mechanisms controlling circadian rhythm. The work showed that there are internal clocks synchronising cellular metabolism and biological rhythms with 24 hour periodicity. This work has brought to the fore the importance of circadian rhythm and its role in health and disease. Āyurveda, with its knowledge on circadian and circa-annual rhythms induced changes in VPK shows the of this information in management of health and disease.

Effect of (a) circadian and (b) circa-annual (seasonal) rhythm on vāta, pitta and kapha.
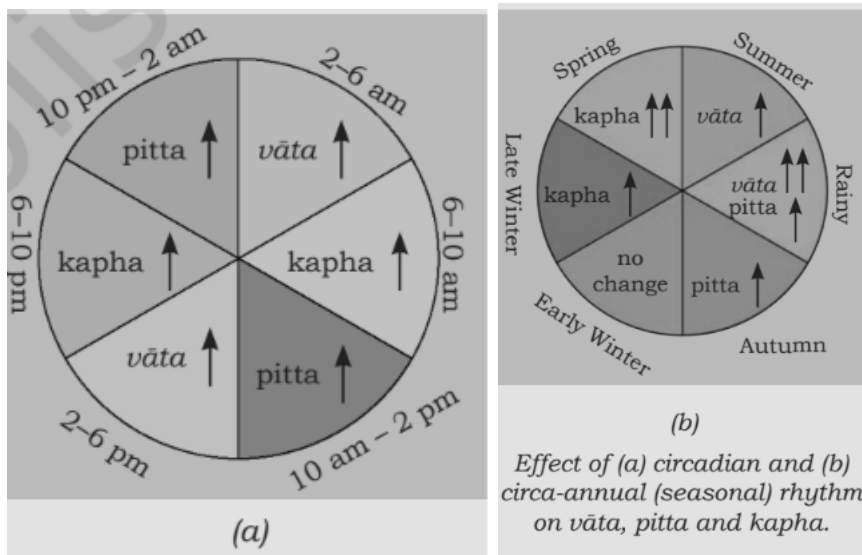
Fig.8.2 – Effect of (a) circadian and (b) circa-annual (seasonal) rhythm on Vata, Pitta and Kapha

Personalized medicine: Western medicine is realising that individual variations in the population limits similar responses to standard treatments. New concepts such as pharmacogenomics, nutrigenomics, etc., which takes into account the genetic variations in the population are being explored to help customize the treatment strategies. Āyurveda uses the concept of prakṛti (bio-psychological constitution) for personalisation of both preventive health and treatment.

Sushrut and Charak

Sushrut

He is known as the 'Father of Plastic Surgery'. During the 6th century BCE, an Indian physician wrote the world's earliest work on medicine and surgery. He was a citizen of Northern India, from Varanasi also known as Kashi or Banaras. *Sushrut Samhita* is highly regarded as one of the great *Brihat trayi* and describes surgical procedures, diagnostic techniques, fractures and their management and treatment for various illnesses. Sushrut is well known for his invention of the practice of cosmetic surgery like *rhinoplasty*, reconstruction of nose or many other parts.

Sushruta was the first person who suggested that a student of surgery should learn about the human body, its anatomy and its organs by dissecting, examining and observing various tissues in a dead body; moreover, this whole dissection procedure was performed without a knife. Sushruta gives surgical procedures on admirable heights and in later stages that era was considered as 'Golden age of Surgery' in mediaeval India.[6]

Charak

History of Ayurveda dates back to the systematised discussion of various acharyas on particular disease held a conference on the foothills of Himalaya mountains. The earliest arranged document on Ayurveda is *Charak-Samhita*, Acharya Charak is known as '*Father of Indian Medicine*'. Under the guidance of *Atreya Muni*, in the 8th century BC, *Agnivesha* wrote the encyclopedic text and then Acharya Charak revised this treatise to gain popularity or known as Charak Samhita.

Charaka studied the anatomy of the human body and various organs. He gave 360 as the total number of bones, including teeth, present in the human body.

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[6] www.planetayurveda.com

He considered the heart to be a "controlling centre" . He claimed that the heart was connected to the entire body through 13 main channels.
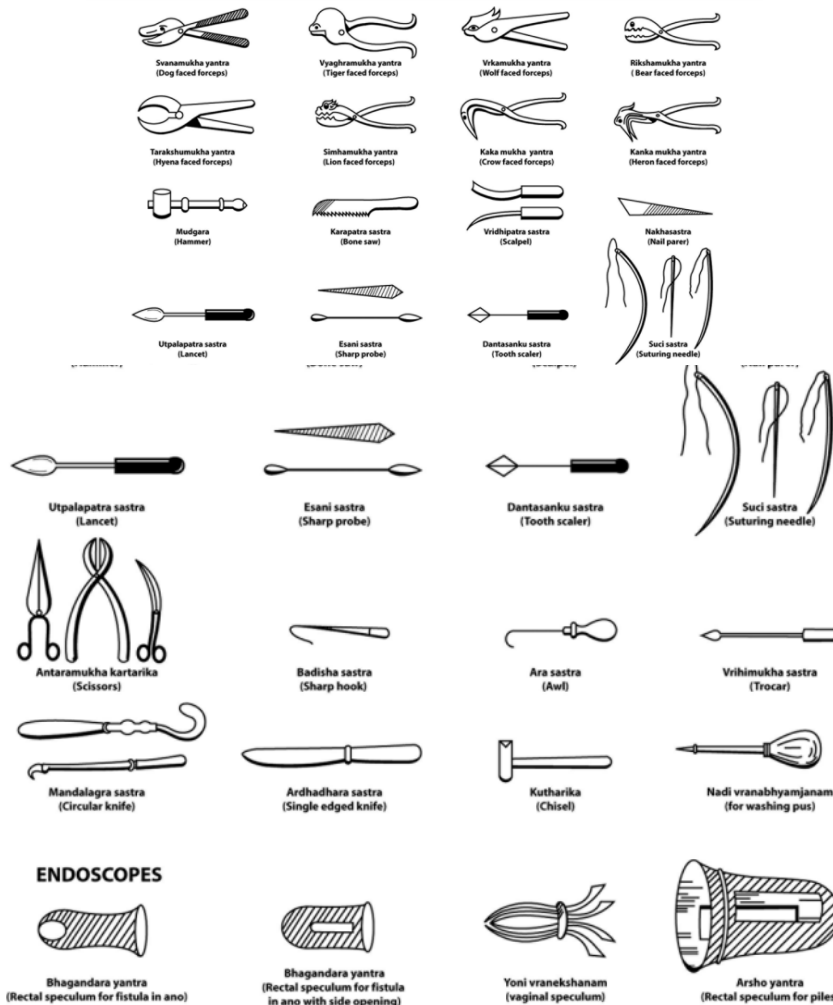
Surgical weapons

Sushruta belonged to a period between 600 and 800 BCE. His conception of surgical instruments, the description of their quality, methods of manufacture and their usage are very unique, as there were no earlier comprehensive descriptions of similar surgical instruments by any surgeon, not only in India but also the whole world. Sushruta was perhaps the first surgeon in the world to describe different types of surgical instruments including endoscopes. This is far beyond the imagination of any other surgeon at that period of time and obviously he was far ahead of his time in this field.

The *Greco-Roman* antiquity abounds in references to surgery. Ancient *Mesopotamians* practiced surgery. *Sumerians* are believed to have used small copper knives for surgical operations around 3000 BC. Mention of some actual surgical operations is found in *Hammurabi's code of law* (about 1700 BC), in which a knife was used by the doctor to operate on a patient. The ancient *Chinese and Japanese* cultures were opposed to cutting into human bodies, so surgical operations were not very common in these civilizations. Sushruta classified surgical operations into eight different categories, viz.

1. भेद्य (Excision)
2. छेद्य (Incision)
3. लेख्य (Scarification)
4. वेध्य (Puncture)
5. इश्य (Probing)
6. आहार्य (Extraction)
7. विश्राव्य (Drainage)
8. सिव्य (Suturing)

Some of the tools designed by Sushruta are shown in the image given below:

Svanamukha yantra (Dog faced forceps)
Vyaghramukha yantra (Tiger faced forceps)
Vrkamukha yantra (Wolf faced forceps)
Rikshamukha yantra (Bear faced forceps)
Tarakshumukha yantra (Hyena faced forceps)
Simhamukha yantra (Lion faced forceps)
Kaka mukha yantra (Crow faced forceps)
Kanka mukha yantra (Heron faced forceps)
Mudgara (Hammer)
Karapatra sastra (Bone saw)
Vridhipatra sastra (Scalpel)
Nakhasastra (Nail parer)
Utpalapatra sastra (Lancet)
Esani sastra (Sharp probe)
Dantasanku sastra (Tooth scaler)
Suci sastra (Suturing needle)
Antaramukha kartarika (Scissors)
Badisha sastra (Sharp hook)
Ara sastra (Awl)
Vrihimukha sastra (Trocar)
Mandalagra sastra (Circular knife)
Ardhadhara sastra (Single edged knife)
Kutharika (Chisel)
Nadi vranabhyamjanam (for washing pus)

ENDOSCOPES
Bhagandara yantra (Rectal speculum for fistula in ano)
Bhagandara yantra (Rectal speculum for fistula in ano with side opening)
Yoni vranekshanam (vaginal speculum)
Arsho yantra (Rectal speculum for piles)

Important texts of Ayurveda

Charaka Samhita — 400-200 BCE - Charaka

Sushruta Samhita — 400 CE - Ayurvedic surgery (shalya)

Ashtanga Hridaya — Vagbhata - physiology of the body and suggestions for therapeutic use of metals and minerals

Sharngadhara Samhita — 15th century AD - Sharngadhara - kayachikitsa

Madhava Nidanam — 700 AD classification of diseases in Ayurveda

Bhava Prakasha — 16th century just now available in English translation

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Notes:

13.

Themes of Arthashastra

(An Ancient Administrative Treatise)

सुखस्य मूलं धर्मः, धर्मस्य मूलं अर्थः ।
अर्थस्य मूलं राज्यं, राज्यस्य मूलं इन्द्रिय जयः ।
इन्द्रियाजयस्य मूलं विनयः, विनयस्य मूलं वृद्धोपसेवा ।
वृद्धोपसेवाय विग्न्यानं, विग्न्यानेनं आत्मानं सम्पद्येत ।
समपदितात्म जितात्मम भवति, जितात्मा सर्वार्थे संयुज्यते ।

Introduction

Arthashastra, composed by Kautilya in 4th century BCE, is a great seminal treatise on statecraft. This political treatise helped Chandragupta to establish Mauryan empire, strengthen, expand it and 1st time making politically united Bharat. The treatise continued till 12th century but in medieval era under many invasions its tradition was lost. Under colonial period systematically we were programmed to believe in Western culture's superiority.

We were doomed to lose all our ancient knowledge. Priceless documents languished unknown to the world. *Professor R. Shamashastry* rediscovered the book in 1904, published in 1909, and wrote its first English translation in 1915. Ever since then, only two more translations that are in English have been written. Now the question arises is, whether the treatise written in the 4th Century BCE is still relevant in the 21st Century?

Kautilys's 'Arthashastra' is fundamentally a book of state anagement.Arthashastra comprises of 15 books. Of these, the first 5 deals with internal administration, the next 8 deals with relations with bordering states and rest 2 are miscellaneous in character.[7]

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[7] www.archive.claws.in

Role of a King

प्रजासुखे सुखं राज्ञः प्रजानां च हिते हितम् ।

नात्मप्रियं हितं राज्ञः प्रजानां तु प्रियं हितम् ॥

"In the happiness of his subjects lies the king's happiness; in their welfare his welfare. He shall not consider as good only that which pleases him but treat as beneficial to him whatever pleases his subjects."

Urbanisation and Management

Kautilya mentions a well-defined hierarchy of the urban centres and the administrative divisions. These division were influenced by the resources available in the region and opportunities for economic development. Size of population was main factor in this arrangement.
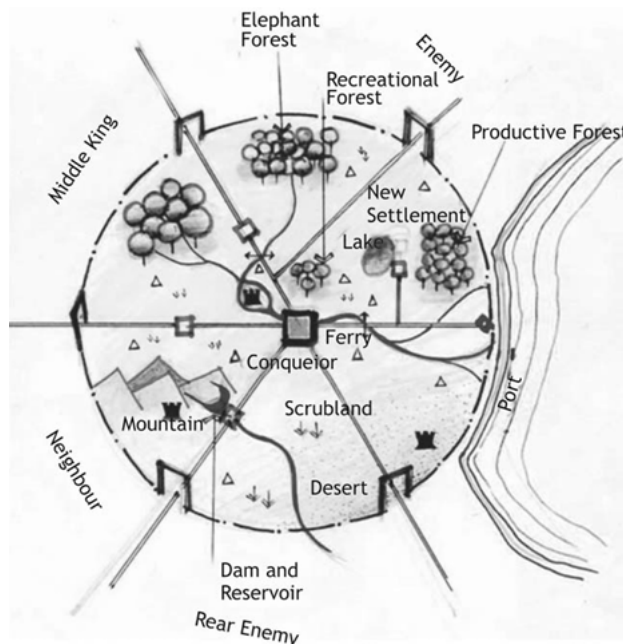

**Fig.9.1 - Hypothetical sketch of the state as per Kautilya**

a. The smallest division was a village. It consisted 100 families and not more than 500 families of agricultural people with boundaries extending as far 2250 yards. Apparently, Kautilya also envisioned certain quality of life for the

inhabitants by specifying population density and kind of physical developments in various parts of the town.

b. Overcrowding in cities has been well managed by Kautilya. He encourages migration to the countryside. This ensured a control over population as well as building densities and thus also reduced the hazard risks in city centres. The policy might also have stated to spread out the population across the nation. This avoided concentration in particular cities or national capitals thus supporting integrated and comprehensive growth of the regions. However, such outward regions were essentially with well-developed agrarian economy.[8]

Saptang Theory

Kautilya has divided the structure of the state in seven parts known as Saptang or Seven Prakritis, these seven elements are:
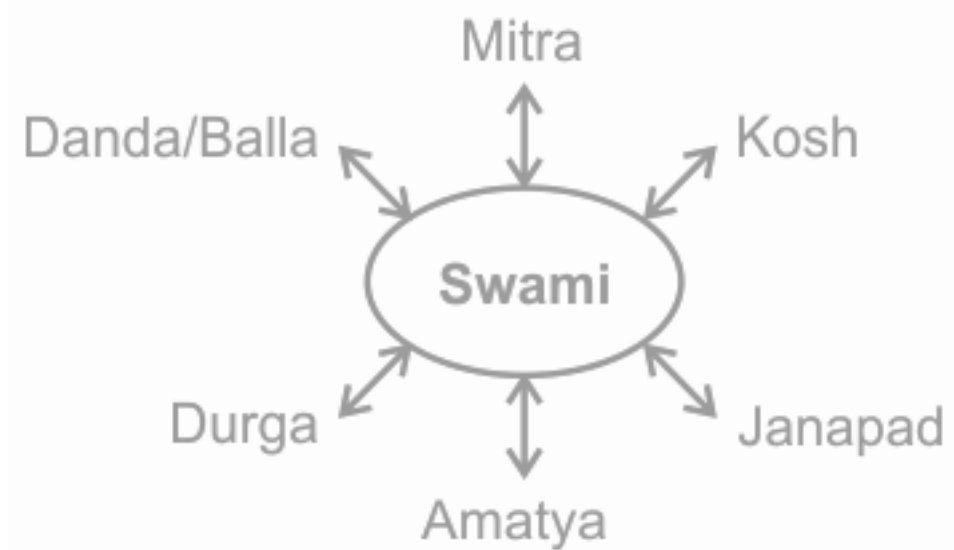
1. **Swami** - Swami means king. He is very central to the state. The king should be dynamic, vibrant, visionary and brilliant.
2. **Amatya** – Chanakya recommends that 3 or 4 councillors should be appointed by the king. There should be control between

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[8] www.scribd.com

control and counsel. Chanakya always focuses on keeping watch on ministers and suggests some tests to check their loyalty. n the tests if they pass then only they will be appointed as councillors. As per their loyalty and other attributes he categorises them in the posts of prime ministers, potential ministers.

3. **Janapada** - Janapada encompasses both territory and population

4. **Durga** – He has categorised forts into 4 types – surrounded by water, built in dense forests, constructed in mountainous area and near the desert without any resources.

5. **Kosha** - Chanakya considers treasure to be more crucial. The treasury was essential for raising and sustaining the army and ensuring the state's stability. Chanakya detailed ways to fill the treasury.

6. **Danda** - The army primarily consisted of Kshatriyas, descendants of the king's forebears, recruited permanently, but people from other castes were also allowed to join the army.

7. **Mitra** - Chanakya, recognised the paramount importance of allies in governance.

Chanakya categorised allies into three types within his Saptanga theory: *Sahaja-mitra* (allies through close relatives), *Krtrima* (allies through reciprocal favours with other kings), and *Prakrta* (allies living near neighbouring kingdoms).[9]

Categories of Yuddha (battles)

Kautilya does not limit the policy of war (Vigraha) to physical conflicts alone. He talks about breaking alliances, oligarchies of an enemy by

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[9] www.ramjaspolreview.com

sowing seeds of contention using cold wars. Kautilya classifies war into four categories:

1. **Mantrayuddha** – Diplomatic negotiations without direct confrontations
2. **Prakashyuddha** – A well planned war with designated place and time.
3. **Kutayudhha** - a secret war, i.e., using treachery and psychological warfare to surprise the enemy.
4. **Gudayuddha** - an undeclared war, i.e., using clandestine methods, assassinations, and secret agents.

Sadgunya (foreign policy)

The purpose of all policies is to grow stronger in the long run than the enemy. All these policies you can apply to todays geopolitics and check its utility.

1. **संधि** – Peace. When king is in weak condition he should adopt peace and build up military capabilities. Ex Shivaji Maharaj after coming from Agra fought no battle but invested in strengthening capabilities of forts, soldiers and horses.
2. **संश्रय** - is seeking shelter with another king or forming an alliance when other state's capabilities are more. Ex india and China relations.
3. **आसन** - is the policy of remaining quiet or neutral. When both the kings are in same power potential, one should wait for right time.
4. **यान** - is military mobilisation. India-Pakistan wars where India played defensive roles.
5. **द्वैधिभाव** - Depending on a variety of complex situations and configurations, Kautilya has prescribed a policy of diplomatic double game. This policy is very demanding with respect to

intelligence, deception, foresight and psychological aspects. India's conflict between Russia and France.

6. विग्रह – If the king is in superior position he should set an expedition and only fighting capabililties should be destroyed not prakriti. Ex. Surgical strike.

Instruments of Foreign Policy

Alongside the Sadgunyas, there are four *Upayas*, i.e., *Sama, Dana, Bheda and Danda* meant for overcoming opposition. The first two should be used to subjugate weak kings, the last two for strong kings. They sum up the means that are helpful in securing the submission of other to own will. Arthashastra emphasises that 'State is fragile organization and the statesman does not have the moral right to risk its survival on ethical restraint.'

Mandal Theory

Through the shape of Mandala (circle) Kautilya developed a political geometry that is counted for different political realities. Kautilya keeps the king (Vijigishu) in the centre. As per Kautilya an empire is like an organism which keeps expanding. Vijigishu is a reference point of Mandala theory and advocates 4 basic circles. Kautilya has used his own political terminology but we will understand it into simple words.
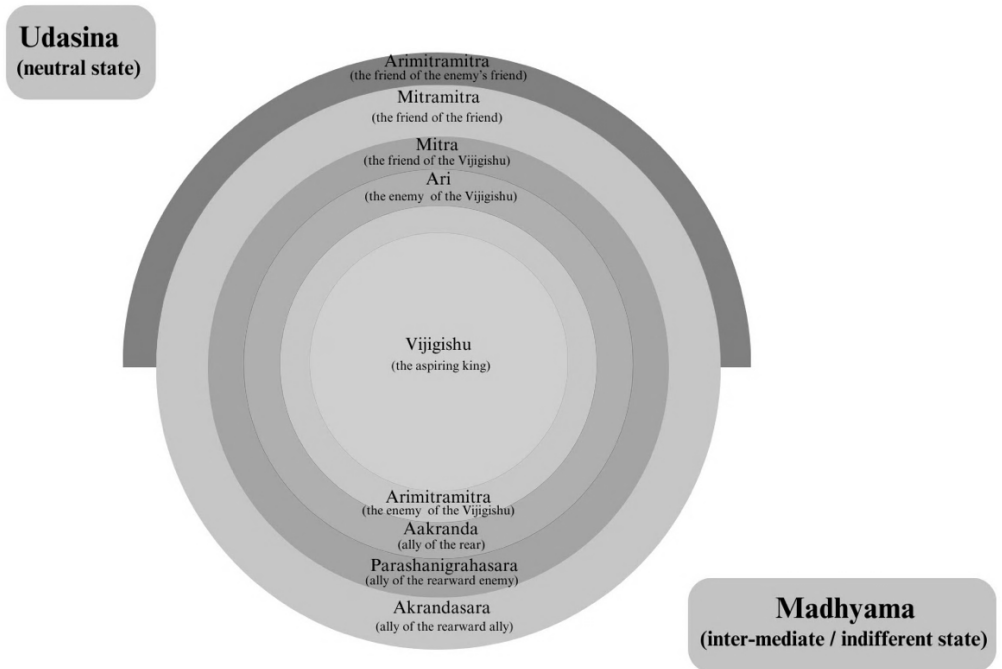
- **1ˢᵗ circle** – It consists of 3 kings-Vijigishu, his friend and his friend's friend. As they all have their 5 own elements of sovereignty such as, amatya, janapada, durga, kosha and danda. Hence, a circle of states would contain 18 elements in total.
- **2ⁿᵈ circle** – It also consists of 3 circles. Vijigishu, ari (enemy of vijigishu) and friends of ari. As per Kautilya, neighbouring country is a natural enemy.
- **3ʳᵈ state** – Madhyama is a state which is indifferent.
- **4ᵗʰ state** – Udasina is a neutral king.

Kautilya and Machiavelli

Polity and statecraft being focused on Europe, Kautilya considered to be Machiavelli of India but the work of Kautilya is much wider than

Machiavelli. In addition to this, Kautilya has written this treatise almost 2000 years before.

Kautilya (India)	Machiavelli (Italy)
Virtues and ethical obligations for the king.	No virtues when it comes to the state or to the king.
believed that there can be no difference between politics and morality and the king should act ethically to promote welfare and happiness in his reign.	power and morality cannot go hand in hand, it is impractical for a king to be virtuous in this realistic world.
advised the king to learn twenty important qualities form twenty different animals which would help him to maintain his state and administration effectively	Machiavelli wanted the king to hold two qualities (1) bravery like a lion, (2) cunningness like a fox.

Both Kautilya and Machiavelli have written on kingship and the ways and manners in which a king should act and behave and how a king should enhance his powers and protect his sovereignty. According to Kautilya justice should be delivered to each and every individual. Kautilya's approach comes out as a holistic mix of idealism and realism.

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Notes:

14.
Linguistics

Source:https://bhashabodha.blogspot.com/2017/12/sanskrit-best-language-for-computer.html

Sanskrit in Computer Programming

Sanskrit has a rich history and was used for early Indian mathematics and science. The grammar of Sanskrit is rulebound, formula-bound, and logical, which makes it highly appropriate to write algorithms. The grammar also makes Sanskrit suitable for machine learning and even artificial intelligence. The integration of Sanskrit into computer programming is a burgeoning field that holds promise for enhancing code readability,

efficiency, and cultural preservation. Existing literature explores various methodologies and tools aimed at leveraging the linguistic richness of Sanskrit for programming purposes. "Sanskrit Programming Language" strives to create programming paradigms grounded in Sanskrit morphology and syntax. The first question that arises is why anyone would use Sanskrit for programming when there are multiple well established programming languages such as Java, C++, Python, etc. that work well with all types of application development. The characteristics of Sanskrit that attracted the attention of computer scientists are:

1. Well-knit syntactic and semantic structure of Sanskrit.

2. Positional independence of words in a sentence.

3. Low phonetic transcription for audio input and binary phonetic classification (0,1) of poetic meter.

4. Well defined rules of grammar, phrasing and synthesis. There is no need for a particular sentence structure for Sanskrit.

Like, In English: - Subject +Verb + Object Ex:- I am writing an answer. But in Sanskrit there is no need for a particular structure.[10]

Sanskrit	English
अहं हस्तेन अन्नं खादामि। (I eat food by hand)	I eat food by hand.
हस्तेन अन्नं खादामि अहं। (I eat food by hand)	By hand I eat food.
अन्नं अहं हस्तेन खादामि। (I eat food by hand)	Food eats me by hand.
खादामि अहं हस्तेन अन्नं। (I eat food by hand)	Eat I by hand food.

Sanskrit and NLP

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[10] Madhav Moole, Flavia Gonsalves. (2022). *Exploring the Application of Sanskrit in Computer Programming*

NLP enhances human-computer interaction, facilitating more efficient integration of AI systems into contemporary applications. Examples include:

• NLP systems for visually impaired individuals to interact with computers via speech input.

• Assistive devices like Stephen Hawking's chair, which converts text into speech.

• Translation programs facilitating communication across different human languages. • Grammar checking software to identify and rectify errors in text.

Sanskrit stands out among languages due to its precisely defined grammar. Learning Sanskrit begins with understanding fundamental rules, unlike other languages acquired through continuous communication. The "*Ashtadhyayi*," a grammatical treatise by ancient scholar *Maharshi Panini*, is revered for its structured approach, akin to a coded language. Sanskrit's rich declension of nouns, organized into eight predefined cases (*vibhaktis*), facilitates unambiguous sentence construction and aligns well with semantic net models used in AI systems.

The eight cases of *vibhaktis* serve specific grammatical functions:

- (प्रथमा-कर्ता) Nominative : Identifying the subject of a sentence.
- (द्वितीया-कर्म) Accusative: Denoting the object of an action.
- (तृतीया-करण) Instrumental: Indicating the instrument used in an action.
- (चतुर्थी-संप्रदान) Dative: Signifying the recipient of an action.
- (पंचमी-अपादान) Ablative: Expressing the point of separation.
- (षष्ठी-संबंध) Genitive: Denoting possession.
- (सप्तमी-अधिकरण) Locative: Indicating the location of an action.
- (संबोधन) Vocative: Addressing a person or object directly.

Sanskrit and Indo European Languages

Modern day philologist believe this very strongly that Sanskrit is one of the oldest evidences we have in proper proto-Indo-European group and therefore Sanskrit Latin and Germanic languages have more similarities in the articulation of the sounds and somewhat in the Spellings for example;[16]

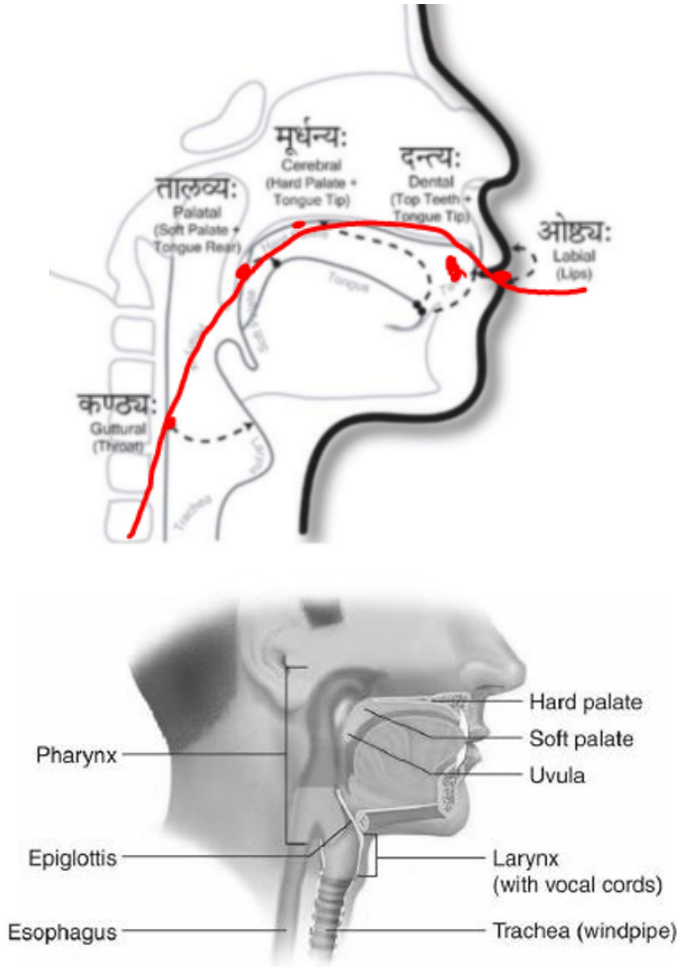| Sanskrit	English/Latin
Matr	Mother/Mater
Pitr	Father /Pater
Na	no
Gau	cow
Naama	name
Dwar	door
Naas	nose
lok(place)	loc (as in locator/location)
Lubh (desire)	love

Expressive Powers of a Word (Shabdshakti)

a) अभिधा : It is the verbal power to convey the literal meaning of words. It is the potency of words to convey their conventional dictionary meaning.

b) लक्षणा : The potency of a word to signify secondary meaning is known as lakshana (indication). It is also called metaphorical usage. Though the indicated meaning is different from the literal meaning, it is nevertheless based on the primary meaning. Secondary meaning arises only when the denoted meaning of a word is incompatible. The phrase गंगायाम् घोषः (house on the river Ganges) cannot be explained by its denoted meaning, because a house cannot be situated on the stream of a river. The meaning of the phrase 'on the river Ganga' can be understood only in terms of indication.

c) व्यंजना : It is the third power of language that inheres in all the elements that constitute poetry. It is the capacity that suggests a meaning other than the literal or metaphorical meaning.[11]

Sanskrit Varnmala and Places of Articulation

Sanskrit varnmala is structured in such a way that the first line to the last line they represent places of articulation from throat to lips. Throat is the first place where sound is generated and lips is the last place which emits the sound.

Source:https://anatomytool.org/content/cenveo-drawing-oral-cavity-and-pharynx-english-labels

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[11] Sirigiri Joyice & Dr.SK.Sheela. (2017). The Influence of Sanskrit in Indo-European Languages: A Study

In Sanskrit Varnmala words have been arranged in such a way that their sequence in the row and the columns comes as per their place of articulation. The science of articulation was contemplated to such an extent India that we don't find such a thought anywhere in the world of that time. Firstly the sound is created in the throat (Kantha), it strikes the palate, tossed to teeth and through lips it comes out. Series of alphabets is arranged in same way in Sanskrit Varnmala.

वर्ग	वर्ण	उच्चारण स्थान	वर्ण का नाम
कवर्ग	क, ख, ग, घ, ङ,	कंठ	कंठ्य
चवर्ग	च, छ, ज, झ, ञ,	तालु	तालव्य
टवर्ग	ट, ठ, ड, ढ, ण,	मूर्धा	मूर्धन्य
तवर्ग	त, थ, द, ध, न,	दांत	दंत्य
पवर्ग	प, फ, ब, भ, म,	ओष्ठ	ओष्ठ्य

Samasya, prahelika

Sanskrit is very rich language not only in words but if you see the literary acumen of Sanskrit Pandits it fanaticizes the literary minds. There are many such shlokas in Sanskrit which play very vital role in intellectual competitions. Samasya, Prahelika are few of them. They lure us to think. Here are some examples of it.

<div align="center">

राज्याभिषेके जलं आहरण्या:

हस्ताच्युतो हेमघटो युवत्या:

सोपान मार्गेण करोति शब्दं

ठं ठं ठ, ठं ठठष: ॥

</div>

In this verse the king gives a problem to courtiers ठं ठं ठ, ठं ठठष: . They are expected to add previous lines contextual to this vogue line. They also have to make sure that the metre of the verse need to be aligned with.

A poet completes this puzzle very artistically. He builds the words saying that 'a young lady brings water into the golden pot for coronation ceremony of the king and the pot slips from her hand. The pot while coming down from the stairs make the sound ठं ठं ठ, ठं ठठष:.' You must have observe the sequence of letter is exactly matching the sound created by pot on each step.

कस्तूरी जायते कस्मात् को हन्ति करिणां कुलम् ।
किं कुर्यात् कातरो युद्धे मृगात् सिंहः पलायते ॥

Here the last line is a puzzle. Which states that a lion escapes from a deer. Its real challenge for the poets to find out meaning of this contradictory verse. How can a lion flee from the deer? A clever poet stands up, connecting these three words with other statements. He asks three questions 1) Where does the Kasturi comes from? Answer is मृगात् (from deer). 2) Who kills the elephant? Answer – सिंहः (a lion). 3) What a coward does in battlefield? Answer – runs away (पलायते).

One can see how the poet has taken care of case (Vibhakti) in puzzle while knitting words into his verse.

कं संजघान कृष्ण: का शीतलवाहिनी गङ्गा ।
के दारपोषणरता: कम्बलवंतम न बाधते शीतम ॥

In this samasya, four questions are asked and answers to them lie in verse itself. The questions are: Whom did Krishna kill? Where is Ganga's coldness is high? Who takes care of his wife? Whom does the cold not affect? Find out the answer.

Hitopdesh and panchtantra

A) Hitopdesha

Origins of Hitopadesha The roots of Hitopadesha are traced back to ancient India, where the tradition of telling tales held a sacred place to impart

knowledge and moral lessons. It is said that Hitopadesha was authored in the 12th century by a sage from the court of *King Dhavalachandra of Bengal, Narayana*. Drawing upon earlier texts in Sanskrit, including the Panchatantra and the Mahabharata, its name translates to "advice that would lead to well-being" or "friendly counsel," which is exactly the purpose intended for readers to gain practical wisdom.

B) Panchatantra

Panchatantra, initially composed in Sanskrit, is a treatise to train foolish princes through the stories of animals. These stories give us the lessons on polity, administration and management. The stories are captivating to such an extent that they have been translated into 200 forms and 50 dialects almost. Panchtantra and Aesop's fables find much similarity because they are derived versions of Panchtantra.

As said by a famous Indologist Sir William Wilson Hunter, Panchtantra was translated into the old Persian in 6th centure CE and from that rendering consequently inferred in Europe. The most old creature stories of India are now the part of curriculum of the schools of England and America.

Structure of Panchatantra

As the story goes, a Pandit named *Vishnusharma* takes a challenge to train foolish princes. He trains them by telling stories of animals and giving lessons of polity, administration and statecraft through them. So after each story a Sanskrit verse comes which gives us a practical lesson to live life better.

Panchatantra has been divided into 5 sections.

1. Mitrabheda (मित्रभेद) – Seperation of friends
2. Mitralabha (मित्रलाभ) – Importance of gaining good friends
3. Kokolukiya (कोकोलुकीय)– Of crows and owls
4. Labdhapranasham (लब्धप्रनाशम)– Loss of gained
5. Aparikshitkarakam (अपरीक्षितकारकं) – Ill-considered actions

Here we will see an example of one of the stories of Panchatantra.

अव्यापारेषु व्यापारं यो नरः कर्तुमिच्छति ।
स एव निधनं यति कीलोत्पाटीव वानरः ॥

"Anyone who tries to poke into matters which are none of his business, meets his end, just like the monkey who tried to remove the wedge."

Near the city limits, a temple was being built by the son of a business man. In the noon time, the carpenters working on that, used to go into the city for lunch. One day suddenly a group of monkeys while roaming came to that place. One of those carpenters had put a wedge in middle of a half-cut arjuna tree log. The monkeys started playing with the trees and logs as they wished. One of those monkeys whose death was near, sat on that half-cut log and started removing the wedge from that. As the wedge moved out, the monkey's hanging genitals went into the gaps of the log, got trapped and the monkey got killed.[12]

Source:https://kathakids.com/folktales/panchatantra-stories/monkey-and-the-wedge/

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Notes:

15.
Education System in India

Source:https://en.m.wikipedia.org/wiki/File:Nalanda.jpg

Education of a child commenced at the age of 5 with the ritual called vidyarambham in vedic system. At this level alphabets were recited and learn by offering them to Goddess Saraswati. But only after Upnayan Sanskar the child would leave home and parents for further education. He used stay at house of the teacher and pursue his studies with strict disciplines of Brahmcharya.

Age for the upanayana ceremony differed from varna to varna. For Brahmins it was 8, for Kshtriyas 12 and for Vaishya boys it was 12. Buddhist ceremony called Prabrajya was conducted at the age of 8 and was same for

all unlike vedic system. After joining monastery he became Sramana and used to wear a yellow robe. In a vedic system, after finishing education brahmchari was eligible to become a Grihasthi (to get married) but in Buddhist system, a shraman was given a full status of Bhikkhu.

Gurukuls, also known as ashrams, were the residential places of learning. Many of these were named after the sages. Situated in forests, in serene and peaceful surroundings, hundreds of students used to learn together in gurukuls. Women too had access to education during the early Vedic period. Among the prominent women Vedic scholars, we find references to *Maitreyi, Viswambhara, Apala, Gargi and Lopamudra*, to name a few.

From the Rigveda onwards, our ancient education started with the objective of developing the students not only in the outer body but also on the inner body. The ancient education focused on imparting ethics like *humility, truthfulness, discipline, self-reliance, and respecting all creations to the students*. The education was mostly given in forests under the blue sky, which keeps the student's mind fresh and alive.

Methodology

Education in ancient India was quite different from the rest of the world back then. Society and state couldn't interfere with the curriculum or the administration. To get an education, a child had to leave home and live with a teacher in a gurukul for the entire duration of his studies. Which course to pursue would be decided by Gurus and not by parents. Guru would observe the child for few months, let him get familiar with Ashram and as per his interest would give him his division. No fee was charged for education; in fact, teacher took care of everything, including food, clothing and housing. The State and the society did not in any way interfered with the curriculum of studies or regulating the payment of fees or hours of instructions.

According to this system, physical labour was of utmost importance. So, even if a child were interested in acquiring philosophical knowledge, he would still have to do some manual work every day. Debates and discussions were a part of education, even in ancient days. Through question and answers knowledge would be imparted. Curriculum was designed in such a way that all 5 rooms (**पंचकोश**) of a being would be developed.

Source:https://www.healthline.com/health/mental-health/koshas#5-koshas
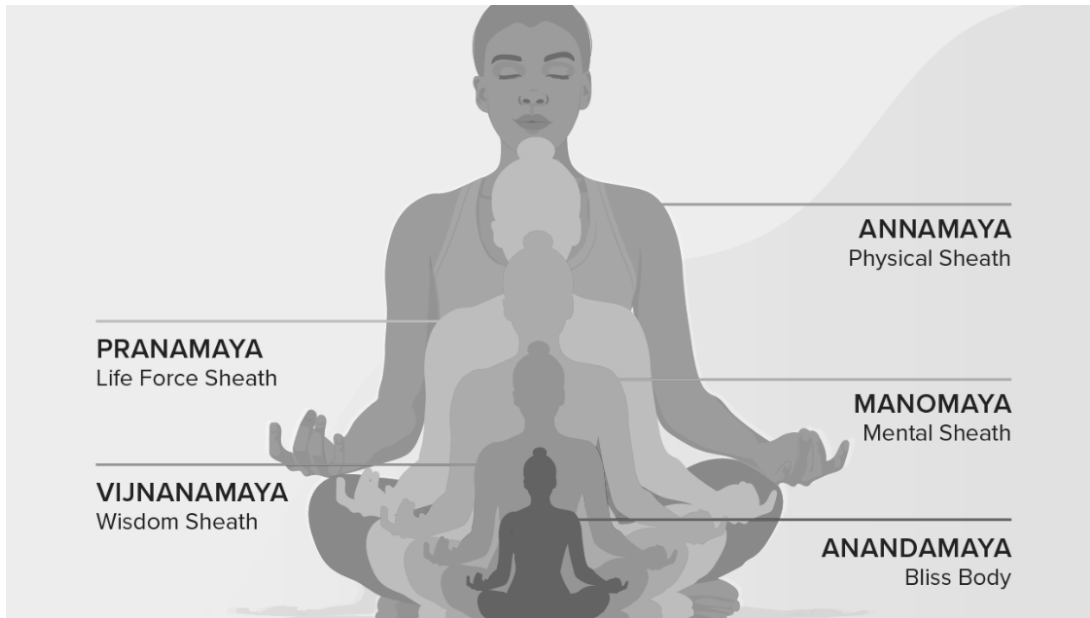
Oral recitation was the basic medium of imparting knowledge. It was practised through various methods like introspection, storytelling, memorisation, critical analysis, practical study and seminars. Oral recitation being a primary method, Vedic people developed various types of recitation methods. They all were based on mathematical calculations of Vedic verses and words with a purpose to retain its core meaning. It was designed rigorously so that not a single letter should be missed out. Their list is given below:

1. जटापाठ
2. शिखा पाठ
3. ध्वज पाठ
5. माला पाठ
6. रेखा पाठ
7. दंडपाठ

4. रथपाठ   8. घनपाठ

Ancient Indian Universities

India used to be a hub of education. Not only from India but there were many countries from where students came to learn in Indian universities like China, Mongolia, Indonesia, Japan, Korea, Sri Lanka etc. These universities were designed for higher education only and before entering students had to give entrance exam. Basic of knowledge of a subject was necessary to study in these universities as we do in modern education system. Almost 16 ancient universities have been recorded by historians, Takshashila being oldest among them. In different eras they were functional and recorded by various foreign travellers and scholars. The list of universities is given below:

Takshahila	Somapura Mahavira	Nalanda
Mithila	Vallabhi	Sharda Peeth
Pushpagiri Vihar	Odantpuri	Vikramshila
Jagaddala Mahavira		

We will study 2 among them, that is, Takshahila and Nalanda in details.

A)   Takshashila

Takshashila became subject to 5 different empires within 4 centuries-the Macedonians, Mauryans, Bactrians, Parthians and Kushanas. As it witnessed these many empire it must have derived genuine culture peculiar to each from these civilisational empires. Unlike todays universities which are known by the names of universities or colleges itself, Takshahshila was renowned by its teachers. They all were experts of their subjects. Their authority was complete and absolute.

1.   Curriculum of the University

Education system was classified into two categories: Literary or general and scientific studies. The curriculum of Takshashila was related to Vedas and subsidiary subjects but they also professed professional subjects

like Architecture, Medicine, Surgery. Archery and Military Arts. Eighteen handicraft subjects, like Greek architecture and arts were taught in scientific and industrial education. Eighteen arts were: Ayurveda, Surgery, Warfare, Jytosh, Book-keeping, Chariot driving Music, Dance, and painting. The study of science, arts, medicine seems to had a practical and theoretical course. More than10,500 students from all over the world studied here. The campus accommodated the students who came from Babylonia, Greece and Arabia etc.

2. Famous Student and Teachers of the University

The University produced in its time three great scholars.

1. Charaka the famous physician who wrote Charaka Samhita on Ayurveda

2. Kautilya (Chanakya), the famous Sanskrit's Grammarian who wrote the book Arthashastra and had given detailed account about social, economic, political condition of ancient India, especially information about life history of Chandragupta Maurya.

3. Panini, who was a scholar of Sanskrit and considered to be founder of Grammar and the study of language and literature.

4. Jivaka was the court physician of Magadha Emperor Bimbisara and personal physician of Goutham Buddha and was the student of Takshashila University.[13]

3. End of Takshashila University

The city was destroyed in 5th century C.E. probably as result of an invasion of tribe of Huns from east. During that time this proud centre of learning got completely extinguished.

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[13] www.aranejournal.com

Source:https://in.pinterest.com/pin/510595676495044295/

B) Nalanda

It was founded by *Emperor Kumargupta* in 450 AD. Chinese traveler *Hiuen Tsang,* have called the emperor Kumaragupta the founder of this university. The word is derived from the Sanskrit language, *na alam da*, which means that there is no restriction on the gift of knowledge, thus the nalanda means to impart knowledge. when Nalanda University was at its peak, around 10000 students from abroad were studying here and more than two thousand teachers were present here to teach them. provided free education here. Nalanda's library was called *Chakla of Religion*. It was the largest library in the world. Library of Nalanda was said to be 9 storeyed. Nalanda University library name was *Ratan Ganj*. As per records this library contained almost 9000000 manuscripts and thousands of books In which the world's rarest information was present. Whole management of Nalanda was done by Vice Chancellor chief Acharya.

From the records of *Itsing* it was known that there was an astronomical observatory at Nalanda which reflects that astronomy as a subject was included. Itsing also revealed that he had studied medicine as a subject, in the University, as the study of Ayurveda and other healing tactics was common in ancient India which kept the monks healthy. One way in which Nalanda University conveys its teaching was the recovery of '*Tattvasangraha*', it was

an encyclopedia which had references about several author and their ideology.[14]

a) Subjects

Logic, astronomy, medicine, and philosophy, political science, mathematics, and the arts. Mahayan Buddhism was given preference in Nalanda.

b) Multinational University

Students came from Indonesia, Iran, Mongolia, Greece, China, Korea, Indonesia, Japan, Tibet, Persia. Entrance test was conducted only for foreign students and not for Indians. As a token of gratitude to this university Indian government has inaugurated newly modified form of Nalanda International University in 2023 which is collaboration of almost 17 countries.

C) Criteria of Admission in University of Nalanda

Hiuen Tsang points out that only about 20 percent of the candidates were successful, others had to retreat back disappointed. It is to be noted that such an entrance exam was applicable to only those who came from different nations, and that the internal students who were already a part of Nalanda's Secondary Department of Education need not face this particular examination. He writes that test was conducted by a guardian kept at the door. In exaggerated form he also writes that mud was formed at the gates by tears of non-selected students.

D) Story of destruction of Nalanda

Bakhtiar Khilji destroyed and burnt Nalanda University. A story is told behind the burning of Nalanda that once Bakhtiyar Khilji fell very ill and his

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[14] www.worldwidejournals.com

own Hakim was unable to cure his illness. He was suggested by someone to get treatment from **Acharya Shilabhadra**, head of Ayurvedic department of Nalanda University. but the pride of Bakhtiar Khilji disallowed him to do so, yet he had to call him.

Bakhtiyar Khilji put a condition before him that he will not inject any medicine but still somehow he wanted to be cured, otherwise he would kill him. Acharya presented him **Holy Quran** next day and asked him to read 5 pages of the Quran for 5 days. After this Bakhtiyar Khilji started feeling well. The reason behind this cure was a smart trick played by Acharya. He secretly had put medicine on pages so when he turned the pages by saliva this medicine was going inside his body.

But ego of Bakhtiyar Khilji could not digest it. He thought if such kind of knowledge was not with his Hakims how it could remain with filthy Indians and he reached Nalanda. After reaching there he saw intellectual grandeur of Nalanda. Seeing the books and bustling universities with scholars he envied the system, and out of jealousy he set the university on fire. Thousands of monks were killed and lacs of manuscripts were burnt. Some monks could run from there and they saved some of the manuscripts.

Historically, Bakhtiyar was not the first to invade Nalanda but his blow was so fatal that Nalanda could not survive it. **Minhaj-i-Siraj,** the Persian chronicler who authored **Tabaqat-i-Nasiri** which explicitly records Khilji's destruction of Bihar and its learning centres. He describes the massacre and plunder by Khilji's soldiers. Other medieval records corroborates these accounts stating that the attack on Nalanda was not merely a military conquest but a deliberate effort to erase India's rich intellectual traditions.

Foreign Accounts of Indian Universities

i.   Hiuen Tsang

He lived in India for 15 years. He Spent many years as student and teacher in Nalanda.

ii.   Xuanzang

The pilgrimage of this Chinese scholar to Nalanda during the 7th century stands as a testament to this transcontinental knowledge transfer.

iii. Itsing

I-tsing was a Chinese Buddhist monk who visited Nalanda University in India in the 7th century and spent 10 years there. He documented his experiences in his travelogue, A Record of Buddhist Practices Sent Home from the Southern Sea.

Contemporary world universities

Plato's Academy, or "The Academy" was founded in ancient Athens in 387 BC by Plato. It was very famous and located outside the city walls. By the name of legendry hero Academos the cite was named as The Academy. Plato first acquired the land on which the academy was to be built. After its completion he started holding informal meetings where he discussed with people and friends. The topic of discussion used to be philosophical tenets.

In the year 86 BC, Lucius Cornelius Sulla, a <u>Roman</u> general and statesman who held the role of consul twice and revived Rome's dictatorship, laid siege to the city of Athens and conquered it. The Academy was destroyed and razed to the ground.

Exploitation by Britishers

Western Education system cut the relation of student and teacher. Teaching was confined to a specific place and lost interconnectedness with the nature. Textbook culture was introduced in India which stopped production of new knowledge in India. Indians became customers of publishers. Teachers lost the authority to decide what to teach and how to teach. Examination methods changed. Students were expected to learn only those part which will come in exam. Purpose of education shifted from gaining knowledge to passing exams. Values were taken out from life and put into education. Ethics and morality became the topics of discussion rather than implementation.

In today's ever dynamic world, where competition is cut-throat, developing skills is the only way to sail through the storm. And that is only possible when are students, right from a very young age, are made to develop these skills. The ancient education system was eradicated by the Britishers to weaken our value system, making it easier for them to rule over us. It is time now to revive and reinvent the ancient practices of imparting education, which suits our modern-day needs.

In modern education system we have molded the definition and confined it to information only. In this process we have simply ignored skills, habits and values. Now its demand of time where we should combine western scientific approach and Indian value based sustainable perspective for new education policy.

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16.

Water Management & Harvesting Systems

Through the Harappan civilisation and Vedic culture hydrologic knowledge seems to be extending in India. The need to manage water propelled the growth of hydrologic science in India like other 12 prominent ancient civilisations of the world. But due to lack of historical documentation these practices remained unexplored and hidden to the world till the recent times.

In Rigveda, Yajurveda. Atharvaveda we mind many references to water cycles, its management and origins. They talk about water quality, hydraulic mechanisms and other structures and nature-based solutions for shortage of water. Harappan civilisation epitomizes different techniques of water sciences like construction of sophisticated hydraulic structures, wastewater disposal systems based on centralised and decentralised concepts.

The Mauryan empire (~ 322 BC – 185 BC) is credited as the first "hydraulic civilisation". Mauryans constructed dams, reservoirs, spillways, channels, ahar and pynes. They had deep understanding of water balance, water mechanism, its management and knowledge of the various

hydrological processes. They would measure rainfall and developed water pricing system. When we dive deep in ancient Indian scriptures, we find many fascinating scientific endeavours for water harvesting systems done by our ancestors. Water was never been only a thing of consumption for Indians but was a gift of nature. Indians worshipped rivers and gave homage to water as a token of their gratitude.

Michael Jansen (archaeologist-1989) *states that the citizens of Harappan civilization were known for their obsession with water; they prayed to the rivers every day and accorded the rivers a divine status. The urban centres were developed with state-of-the art civil and architectural designs with provisions of sophisticated drainage and waste water management systems. Agriculture was the main economic activity of the society and an extensive network of reservoirs, wells, canals along with low cost water harvesting techniques were developed throughout the region at that time (Nair, 2004). The Mohenjo-Daro and Dholavira, major cities of Indus 47 Valley are the best examples having the state-of-the art water management and drainage systems. The Great Bath 48 of Mohenjo-Daro of Indus Valley is considered as the "earliest public water tank of the ancient world". The 49 "Arthashastra" attributed to Kautilya "who reportedly was the chief minister to the emperor Chandragupta (300 50 BC), the founder of the Mauryan dynasty.*[15]

Water Harvesting Systems in India
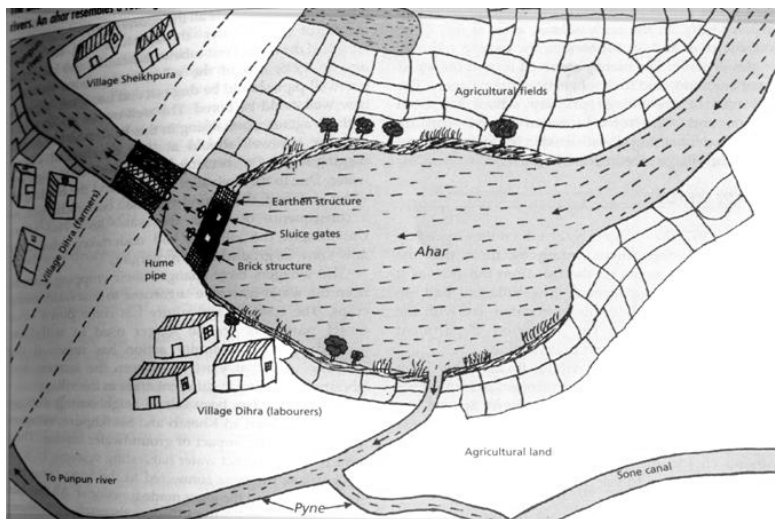
A) The Pynes and Ahars

The Pynes and Ahars (combined irrigation and water management system), reservoir (Sudarshan lake) at Girnar and many other structures were also built during the Mauryan empire (322-185 BC). This system is

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[15] **Michael Jansen. Mohenjodaro, City of the Indus Valley**

collective work of community where they come together and make channel to carry water from hills and bring to different embankments. From these embankments water is relesasd to areas where slope leads. It was widely used in South Bihar. It enables farmers to cultivate rice, barley and wheat.

Ahars: Embankments to capture water.

Pynes: Channels that carry water from hilly rivers to agricultural fields.

source:https://homegrown.co.in/homegrown-explore/the-answer-to-indias-water-woes-may-lie-in-its-history

B) Zings (The region of Ladakh)

The most easily accessible source of water in this region are the glaciers containing fresh water. Parts of the glaciers naturally melt under the sunlight during the day and the water from it is guided and collected into tanks called "Zings" through a network of channels.

Source:https://www.researchgate.net/figure/Zing-water-harvesting-structure-in-Leh-India_fig3_339714371

c) Johads

It is one of the oldest and most prevalent water management systems in arid region of India. They are earthen check dams with naturally elevated surface on 3 sides and a retaining wall created from the excavated soil from the storage pit on the fourth side. Their function is to store rainwater and help recharge groundwater. In regions with heavier monsoons, these Johads are interconnected with smaller channels which can be opened up into a stream or river so as to avoid any structural damage to the Johad.

Source:https://rangde.in/blog/the-waterman-of-india-rajendra-singh
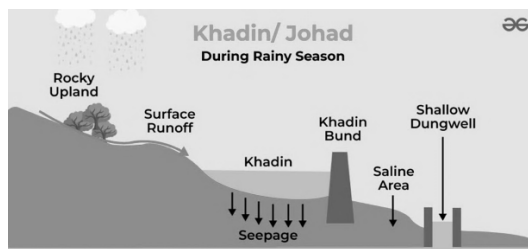
D) Bawaris

They are another unique type of stepwells. The rainfall received in the region would be diverted to these man-made tanks through canals built on the hilly outskirts of cities. The water then percolated and recharged the ground water

as well as the aquifers below. Layered steps were built around the wells to deepen and narrow it down to reduce loss of water through evaporation.

Source:https://en.wikipedia.org/wiki/Sun_Temple,_Modhera

E) Khadins or Dhora

are also indigenous to this region where rainwater is harvested directly on farmlands with spillways and sluices that help drain the access water into storage pits and the land saturated with water is later used for agriculture purposes.

F) Bamboo Drip irrigation System

It is a type of micro irrigation system being practiced in North east India for the past two centuries that diverts water from perennial springs into terrace fields using bamboo pipes of variable shapes and sizes. The water is directly delivered to the roots of the crops and this system is most efficient for low water demanding crops. This method is predominantly used for black pepper cultivation by the farmers of Khasi and Jaintia hills.[16]

Anai Cut Dam

The Kallanai Dam was built during the 2nd century AD by *Karikalan*, a king of southern India's old Chola Dynasty and is also one of the oldest irrigation systems in the world that is still in use.

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[16] Ranga Naga Satyanarayana Murthy, Ramesh Srikonda, Iyer Vijayalaxmi Kasinath. (2022). Traditional Water Management Systems in India.

Specialities

a. Kallanai Dam is the 4th oldest dam in the world, and 1st in India.

b. It is a rock-solid project that has survived 2,000 years.

c. The purpose of the dam was to divert the waters of the Kaveri across the fertile Thanjavur delta region for irrigation via canals.

d. The Kallanai is an anicut of unhewn stone that stands in the Kaveri parallel to the riverbank; it is more than 300 m long, 20 m wide, and 4.5 m high. It is believed that Kallanai initially irrigated about 69,000 acres, though it now irrigates close to 1 million acres (13,20,116 Acres).[17]

Source:https://en.wikipedia.org/wiki/Kallanai_Dam
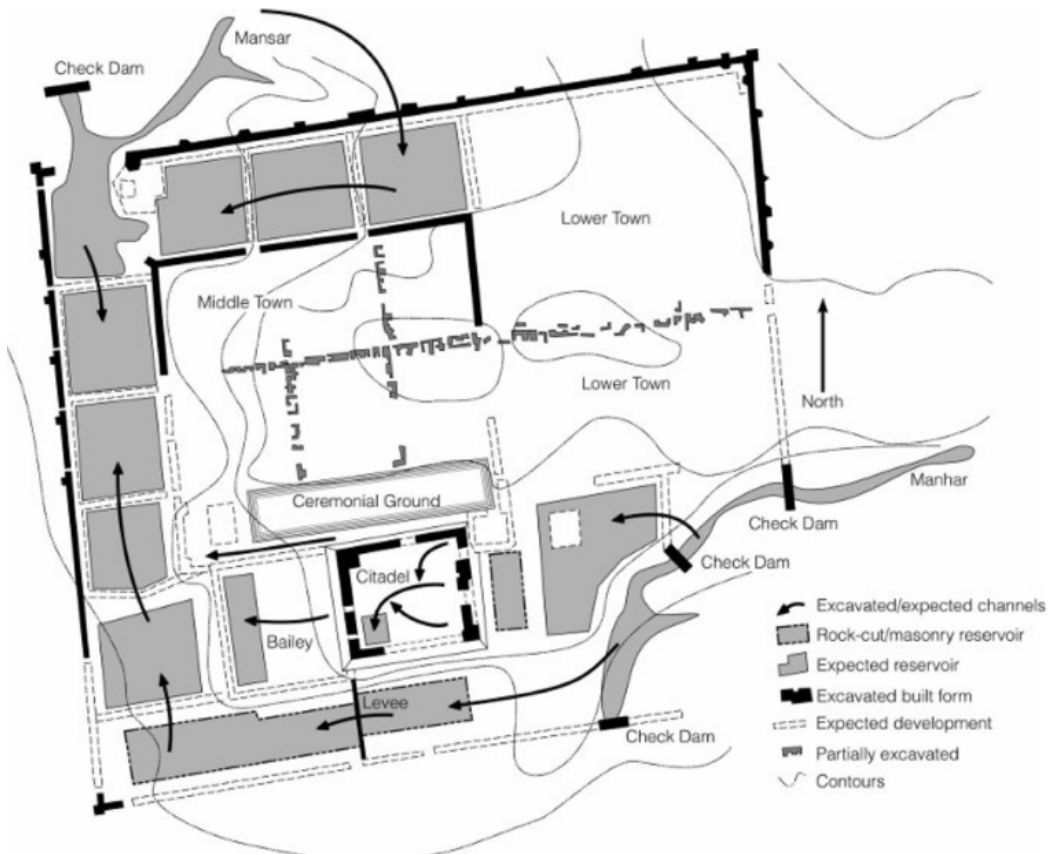
Dholavira Water Management

Harappans were very well familiar with seasonal rainfall, flooding and irrigation system. They had good knowledge of water management and conservation of natural resources. It is expected that climatic conditions of Harappa were not like todays conditions. Ghaggar river is supposed to be draining northern part of Rann of Kaccha. The city of Dholavira was built between 2 streams: Mansar (North) and Manhar (South).

Mansar : The water from Mansar stream was diverted through the channel to the 3 reservoirs built in a sloping way on the periphery of the city.

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[17] **icid-ciid.org**

These reservoirs had open able channels and causeway for maintenance. If the water was substantial in the stream the reservoir to the west also would have been filled. At the end (North western part of city) a check dam ensured that almost no water proceed further downstream.

Manhar: In south part of the city, water brought to south periphery of the city. A check dam at South east direction tried to store maximum water in the city. To the south of the citadel 5 tanks have been excavated. The largest one among them is 33 metre east-west and 10 metre north-south. The average depth of the tank is almost 6 to 8 metre.

Source:https://www.re-thinkingthefuture.com/travel-and-architecture/a12716-unesco-world-heritage-sites-dholavira-a-harappan-city/

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Notes:

17.

Trade & Commerce in India

Northern India

Mesopotamian & IVC Trade: The scroll headpiece of a Harappan clay closely matches with the emblem of a Babylonian goddess, implying trade links between the 2 lands. Babylon was an ancient Mesopotamian city. Another references like clothing, medicinal herbs, incense, scent material and so on stand as testimony between trade connections between Meluha and Mesopotamia. Sumerians used to Harappa as Meluha.

FIGURE 35.11. Indus-style combs made from elephant ivory from (a) Ras Al-Jinz RJ-2 (photograph by D. Frenez, courtesy Oman National Museum), and (b) Bat Grave pit 0025 (Thornton *et al.* 2016: fig. 1.3).

Source:https://www.harappa.com/sites/default/files/pdf/The_Indus_Civilization_Trade_with_the_Om.pdf

Roman Trade: Periplus of the Erithrean Sea, composition of 1st century

CE, is a record of Sea trade of Rome with other countries. It is a trade manual between trade networks in Red Sea and Bay of Bengal produced by Greeks. This text lists down the list of commodities India and Roman empire exchanged with each other. This list includes beryl, silks, muslins and cotton like fibres. Spices, fragrances, valuable stones were all in great demand. The manual also records the best quality cloth Muslin from the Ganga or Vanga area.

Chinese Trade: Chinese silk was imported at Kanchipuram and exported to Malaya from there. Kanchipuram was itself a great centre of indigenous silk manufacturing, therefore it's reasonable to assume that local silk was involved in the trade which was shipped to Malaya. Kanchi's fame for producing enormous, gleaming pearls and unusual stones, which were swapped for gold and silk items. All these testimonies suggest that silk fabrics played a significant role in Indian trade.

We discover unique prayers in the Rig Veda for attaining wealth through seafaring interests. *Pani* was a merchant guild that supervised and controlled commercial activities. *Mana* was the medium of weight, and the car was an essential unit of commerce. With the integration of the Panis, a composite *Vaisya class* formed later on. Agriculture, trading, and livestock breeding were the occupations of the Vaisya class, according to several *Dharmasutras*. Brahmans were taking part in trade and commerce is also known from *Manusmriti.*

Maurya & Kushan Time

Manufacturing activity was brisk throughout the Mauryan rule, according to Greek sources, who mention the fabrication of chariots, carts, weaponry, and agricultural tools, as well as the construction of ships.

Strabo (Greek Geographers 64 BCE – 24 CE) mentions :
Imports - gold-embroidered dresses, floral robes made of excellent cotton,

Fine wines, colourants, glass vessels, costly silver vessels, singers and beautiful maidens for the harem, and the finest ointment were among the items imported into India.

Exports - India exported fine silks, muslin, spices, perfumes, medicinal herbs, indigo, sandalwood, pearls, ivory, iron, steel, and so on.

Kautilya suggested in his Arthashastra to appoint various officers to look after trade. Following are the posts he talks about:

a. Naukadhyaksha (superintendent of shipping) – to control waterborne trade
b. Mudradhyaksha (superintendent of treasure) – to control wealth from seatrade
c. Panyadhyaksha (superintendent of trade & customs) – to oversee overall trade regulations including collection of duties on commodities.

As per Kautilya Haimvatmarga (route from Balkh to India via Hindukush) was used only for the trade of horses, woolen textiles, skins and furs. Other products like diamonds, precious stones, pearls and gold etc were sold on Dakshinpath or Deccan Route. Mauryan administration was more interested in the affairs of industries and industrialists than it had been previously.

Source:https://owenrees.substack.com/p/rhapta-a-town-in-ancient-tanzania
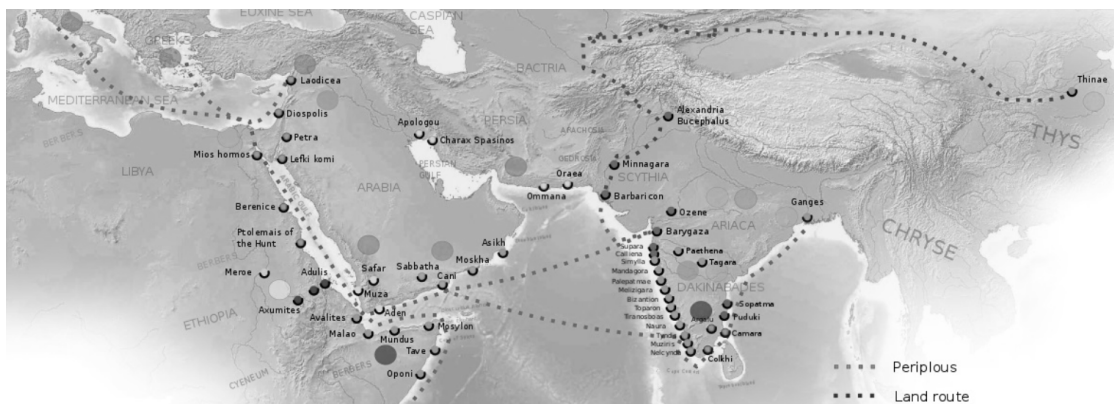
Trade during Guptas and later period

Nagara shreshthi (chief banker). The *Jambudvipa prajnapti*, a Gupta-era document, describes eighteen ancient guilds, including silk weavers (pattailla), napkin dealers (ganchhi), calico-printers (chhimpa), and tailors (sivaga). Guptas not only expanded their eastern trade but also opened up western sea-borne trade, resulting in unparalleled economic success.

The wealth of the Roman Empire began to stream into India through the western coast ports of Broach, Sopara, Cambay, and Kalyan when *Chandragupta II* opened up the western trade. Arabs used to travel to the west coast to buy teak, medicines, perfumes, shoes, black salt, spices, indigo, textiles, muslin, and other items, and Indian goods were extremely popular in Arabian countries.

Decline of North Trade

Trade and commerce declined between 7th and 10th centuries in North India. As a result, cities and urban life fell in this region. The fall of Roman empire in the west and Iranian empire, resulted in severe shortage of gold and silver coinage in North India. The situation of North India altered notable with the establishment of a powerful and widespread Arab kingdom in West Asia and Africa. India was rules by number of mighty kingdoms throughout this period. Pratiharas, Palas and Rashrakutas are some of them.

Southern Trade

The Cholas, who rose to prominence in the 10th century A.D.gave a huge boost to international trade. Merchant guilds such as *Manigramam, Nanadesis, and Ainnurruvar* took part in sea-borne trade that stretched from the Persian Gulf in the west to Indonesia and China in the east. Trading

expeditions were sent by the Chola mperors to China.

Export: Cotton textiles, spices, pharmaceuticals, gems, ivory, rhinoceros horn, valuable stones, and fragrant items, ebony and camphor, elephants, cardamom.

Import: Arabian Horses

Major Ports: Mahabalipuram, Kavirippumpattinam, Korkai

Cholas

During the Chalukyan period, the *Ayyavole guild*, based in *Aihole (Karnataka),* travelled over the world carrying priceless items in their luggage. They made philanthropic contributions as a group. The banks of these guilds were so stable throughout the *Rashtrakuta* period that they inspired the greatest level of public trust.

During the period of Cholas, barter system was prevalent still people chola coins were in great demand to purchase commodities from abroad. Chola coins were generally made up of gold and weighed 5 grams. In maritime history of India Cholas stand unparalleled in its grandeur and glory. *Ibn Batuta and Marco Polo* writes that India had an extensive network of trade with China other south east Asian countries.

Kanchipuram was important trading centre of textile. The weavers of Kanchipuram were specialised in making royal robes. Tanjavur Inscription gives a detailed viewof professions observed in south India. Metal industries, jewelers, household utensils were at its peak. Extracting alloys of metals like copper, bronze, gold, silver and art of casting them into refined idols was

mastery of these artisans.

Shiva as Nataraja, the Lord of Dance
(c. 950–1000 CE)

Pandyas

Pandyan kingdom is well known for its pearl fishery at Korkai port. Ptolemy (Greko-Roman astronomer) calls Korkai port as "an emporium pearl fishery". The yield of pearls brought crores of rupees in India. Chanakya also writes about pearls from Pandyan kings. Extensive trade of perfumes and pearls made one of the Pandyan kings to dispatch an embassy to the Roman Emperor Augustus Caesar which was welcomes by him at Athens.

The Chung dynasty that followed the Tang dynasty made the situation more normal and the trade began to flourish once more. Cholas were eager to use this opportunity and sent several trade missions to China. In fact, the market structure and economic policies of the Chola dynasty were more conducive to a large-scale, cross-regional market trade than those enacted by the Chung court. The Chinese Chung dynasty reports record that an embassy from Chulian (Chola) reached the Chinese court in the year 1077 A.D. and the king of the Chulien at that time was called Ti-hua-kia-lo. It is possible that these syllables denote "Deva Kulotunga" (Kulothunga Chola I).

This embassy was a trading venture and ended very profitable to the visitors. They returned with 81,800 strings of copper coins in return of some articles of tributes including glass articles, and spices.
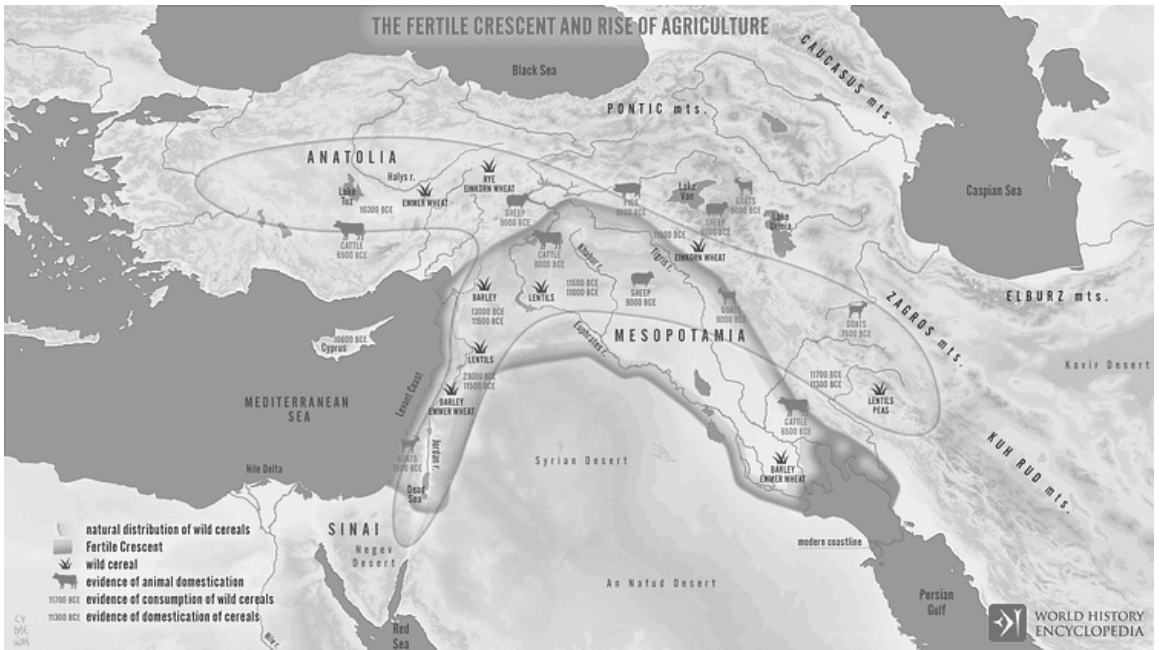
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Notes:

18.

Agriculture

अश्मा च मे मृत्तिका च मे गिरयश्च मे पर्वताश्च मे
सिकताश्च मे वनस्पतयश्च मे हिरण्यं च मेऽयश्च मे
सीसं च मे त्रपुश्च मे श्यामं च मे लोहं च मेऽग्निश्च मे
आपश्च मे वीरुधश्च म ओषधयश्च मे
कृष्टपच्यं च मेऽकृष्टपच्यं च मे ग्राम्याश्च मे
पशव आरण्याश्च यज्ञेन कल्पन्तां वित्तं च मे
वित्तिश्च मे भूतं च मे भूतिश्च मे वसु च मे वसतिश्च मे
कर्म च मे शक्तिश्च मेऽर्थश्च म एमश्च म इतिश्च मे गतिश्च मे ॥

Introduction

Our ancestors were forced to lead the life of nomads. Then, around 12,000 years ago, Agriculture came into existence which marked the start of the Neolithic revolution. Agriculture anchored human civilization to lead a settled life. Agriculture and animal domestication began in the "Fertile Crescent" of the Mesopotamian civilization. The first civilizations flourished around the banks of rivers such as the Nile of Egypt and the Yellow River of China. One such civilization was The Indus valley civilization on the north-west Indian frontier. There are shreds of evidence to support the idea of flourishing agriculture in the ancient Indian subcontinent. Evidence is also found in the Vedic literature. Vedas being one of the oldest scriptures describe a lot about ancient Indian agriculture.

Ancient Indian farmers developed agricultural practices that ensured ecological balance. India developed a holistic agricultural knowledge based on scientific intellect. A lot of ancient agricultural practices are recorded in the classical texts related to agriculture.

- Kautilya's Arthashastra
- Varahmihira's BharatSamhita,
- Patanjali's Mahabhasya
- Surapala's Vrikshayurveda
- Krishi-Parashara

These are some of the ancient texts that throw light on agriculture during the Vedic time period. Agriculture in ancient time had much of a religio-social importance, and the ancient agricultural practices were developed for all the sections from soil, crop management, Irrigation and even weather forecasts.

What Green Revolution cost us?

- Depletion soil organic carbon
- Depletion of ground water
- Water pollution
- Overuse of fertilisers
- Loss of biodiversity
- Loss of seed security

Sustainable Agricultural Practices

India was a land where farmers were considered as Annadata. They held utmost importance in Indian society. When Bharat comes to meet Rama in forest he asks him about welfare of the farmers. Maharshi Valmiki narrates

it very gracefully in Kacchhitsarg. But in the course of time under the rule of foreign powers like Mughals, British farmers became only tools to provide wealth to these powers through taxes.

In Indian agricultural practices seed quality and its storage has been endowed with a great importance. Parashar smriti states that uniform seeds give high yield. Kashyap says that Kings should arrange the preservation and distribution of seeds in time.

Manure (Kunapa) of Surpala
Method

1. **Mix and store the mixture of excreta, marrow of the bones, flesh, brain, blood of the boar with water (Kunapa).**
2. **Collect and store fat, marrow and flesh of fish, ram, goat and other horned.**
3. **Boil and mix it with water and store it in an oiled pot after adding husk into it.**
4. **Roast in an iron pot, add sesame oil cake. Then add soaked black gram and pour little ghee into it.**
5. **Keep in warm place.**

Surapala wrote Vrikshayurveda in 1000 CE after almost 1400 years of Shalihotra. The original manuscript of the book has been preserved in Bodleian Library Oxford University of London.
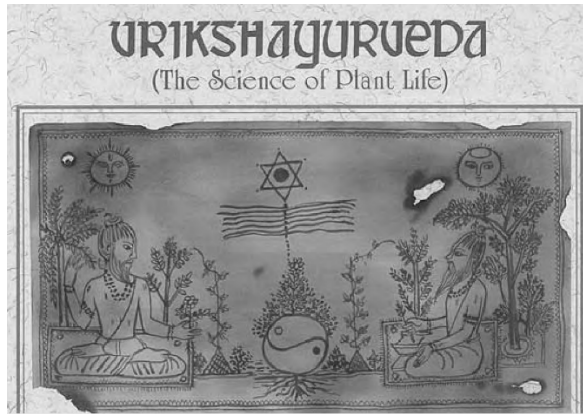
Vrikshayurveda

Around 400 B.C. Salihotra wrote Vrksayurveda must have been a different person living in the times before Christ. Apart from Vrksayurveda the diseases of trees and their treatment are dealt with in 'Brhad samhita' and 'Agnipurana'.

1.   भूमि निरुपण (Types of Soil) This part of the book tells us about 3 types of soil.

     i)   Jangalam – very less water and very less vegetation

     ii) Anupam – rich and fertile land with irrigation

     iii) Sadharan – not fertile not barren

1. बिजोप्रिविधी – It deals with treatment of seeds. Before planting, the seeds should be mixed with ashes and exposed to treatment by medical smoke. It talks about the sesame plant and bean family which carry nitrogen with them.

2. पादपविवक्ष – This part talks about the biology of a plant. Just like living beings trees also have life and like thirst and hunger even they need sleep. In this chapter one can read about suh creepers which go to sleep after sunset. *Jagdish Chandra Bose* even introduced a concept of *the weeping of trees*.

3. रोपणविधान – How to plant saplings? Even depth of pits is mentioned here.

4. निषेकन विधी – Irrigation and fertilisation

5. पोषण विधी – Fertilisers are prescribed for undeveloped and underdeveloped trees and plants called *Kunapajala*.

6. दृमरक्षा – When a tree is affected by vermin, storms, winds etc, what is to be done at this point is discussed in this chapter. Unflowering tree after exposing to smoke yields flowers, is successfully tried by experts.

7. तरु चिकित्सा – Sugery of a tree

8. उपवन क्रिया – art of gardening is elaborated in this chapter

9. निवेश सन्न तरु शुभाशुभ लक्षण – It proposes bad and good omens about the trees. Which tree to plant which side of dwellings.

10. तरु महिमा – It emphasizes the importance of a tree. It narrates it very nicely and compares a tree with 10 sons. Not only this but adds that by planting trees our ancestors can attain liberation.

11. चित्रीकरण – This part of the book is wonderful expression of hybridisation of trees like how nonfragrant flower can adopt fragrance, non-colour to colour. It also talks about how to make a plant bloom throughout the year.

Remedies for Increasing Land Fertility

- **Arthashastra** – crop restoration with restorative plants
- **Varahmihir** – Green manuring with husk of barley
- **Krishi Parashar** – Manuring recommended with cow dung, animal bones, urine etc.

Ancient Indian Crops

Wheat, Barley were staple crops in India and were used for making beverages also. Rice was another crucial crop which thrived in wetter climate.

As it required more water for cultivation. A great network water management system emerged in India. Pulses were cultivated not only for their protein rich property but also for giving fertility to soil back through nitrogen fixation. Drought resistant crops like bajra, ragi also played important role during food scarcity. In Production of Turmeric, Cardamom, black pepper India had monopoly and all of them were of immense importance to international trade.

Irrigation Systems

i.   Wells and Stepwells: Ancient Indians developed intricate well systems to access groundwater. Stepwells, such as the famous Rani ki Vav in Gujarat, were not only sources of water but also architectural marvels that showcased the importance of water management.

ii.   Canals and Dams: The construction of canals and dams was a hallmark of ancient Indian agriculture. The Indus Valley Civilization, for instance, had a network of canals for irrigation. Dams were built across rivers to store water during the monsoon season, ensuring a continuous water supply for crops.

iii.   Tank Irrigation: Tanks or artificial reservoirs were created to store rainwater. These tanks provided water for irrigation during dry periods and were essential for regions with erratic rainfall patterns. Sloping Fields In regions with gentle slopes, ancient Indians employed a technique known as contour farming. This method allowed rainwater to flow slowly across fields, reducing soil erosion and maximizing water retention.

Development of Agriculture in India

Through the above-mentioned texts of agriculture, we are told that the sage lists four types of clouds: Aavarta, Samvarta, Pushkara, and Drona.

The farmers are advised by the sage to observe the monthly rainfall

beginning with Paush that is the mid of the month of March. Parashara stresses that to know the quantum of monthly rainfall the observer of the weather has to work every day and keep track of the direction of winds by fixing a rod with a flag attached to it. According to Parashara, wind from the north or the west brings rain and that from the east or the south indicates absence of rain.

Following topics are discussed in these treatises: Management of cattle, manure, the plow and other implements, the plowing, seed collection and storage, sowing and planting, water retention, weeding, draining of water, plant protection, water harvesting etc.

Weather Forecasting

Since the time of Yajurveda Indians knew the importance of water and its circulation. Evaporation, condensation these processes of climate were known to them with their own terminology. As per their observation of the changes in nature they could predict the time of coming rainfall. Here is a quote from Shatpath Brahmangranth, Shukla Yajurveda.

अग्नैर्वे धूमो जायते । (Heat created vapour)

धूमात् अभ्रम : । (Vapour creates clouds)

अभ्रात् वृष्टी । (Clouds Bring rainfall)

Agricultural Tools described by Parashar

Source:https://shastragyan.in
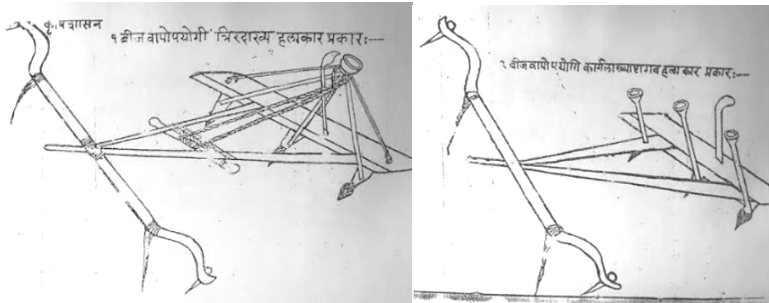
19.

Textile & Dyeing Industry

The cotton handloom industry of India is one of the great manufacturing institutions of the world: its looms have run continuously for 5000 thousand years. Remnants of cotton thread have been found in the ruins of the Harappan civilization [5000-3500 BC], and the weavers of India have supplied the markets of the world with cotton cloth since at least the 1st century of the Christian era.

The golden age of Indian cotton in recorded history stretches from that time until the beginning of the nineteenth century and there are testaments to the quantity, quality and variety of Indian cotton fabrics scattered through written records. Indian textiles were traded for Roman gold at the time of the Roman Empire.[23]

History of Indian Cotton

Cotton was firstly used in India in Harappan site known as Mehergarh. Alexander invaded western part of India. He lived there with his soldiers for almost…. Years. It is believed that the Greek soldiers were fond of Indian

clothes. Owing to the great expanse of Indian trade, India had a share of almost 30 percent of the world GDP.

Romans having no commodities to exchange with India, they poured India with gold coins as a medium of exchange. Pliny, a Roman historian, expresses his concern about this drain of gold in Rome and asks to ban Indian trade.

The Priest King

The priest king is considered one of the most famous stone sculpture of Mohenjodaro, Pakistan. This torso is carved with a shawl of a cotton with beautiful design on it. This sculpture is made up of a steatite. This cloak is similar to a toga but only covers one shoulder.

Accounts of Foreign Travellers

i) Pliny, the Roman historian of the 1st century AD, calculates the value of imports of Indian fabrics to Rome at a hundred million sesterces [equal at the time to 15 million Indian rupees] every year, and complains that India is draining Rome of her gold.

ii) Suleiman, an Arab trader who visits Calicut in 851 CE writes in his diary "…garments are made in so extraordinary a manner that nowhere else are the like to be seen. These garments are woven to that degree of fineness that they may be drawn through a ring of middling size."

iii)   Tome Pires, a Portuguese traveller of the 16th century writes in 1515 from Malacca describing the ships that come there from Gujarat and the Coromandel coast, worth eighty to ninety thousand cruzados, carrying cloth of thirty different sorts.

iv)   Pyrard de Laval, a French traveller in the early 17th century says Indian fabrics clothed "everyone from the Cape of Good Hope to China, man and woman…from head to foot." Certainly, the largest manufactured trade item in the world in pre-industrial times, Indian cotton cloth, paid for in gold and silver, was the source of India's fabled wealth.[18]

Types of Clothes in India

Indian textiles, by 100 C.E. had found a good market beyond the subcontinent. Persians admired the bright color of Indian textiles. Indian muslin called "nebula," "gangetika," and "venti" became popular in Rome. Imports included silk, obtained mainly from China, though many other goods were also shipped to Rome.

The Buddhist literature also mentions the numerous fabrics that were used by the people, such as Khoman or linen, kappasikam or cotton and kosseyam or silk. The Jataka tales also mention spinning and weaving as specific professions, as well as the numerous tools that are utilized in its creation.

Ikat is an ancient process of fabric designing in which threads are first planned into certain designs before dying. This way of seaming also allows for very complex patterns to be embroidered directly on the garment materials.

Patola, the Patan double ikat fabric of Gujarat, is considered to be extremely sophisticated and has dense graphics, and beautiful colours. This

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[18] www.vishwaayurveda.org

fabric occurred as a prestigious good in India and was much valued in Southeast Asia in the seventeenth century. Patola was exported to the Philippines, Malaysia, Borneo, Thailand and Indonesia to be used in wedding ceremonies and temples.[19]

| Patola Saree | Calico | Muslin |
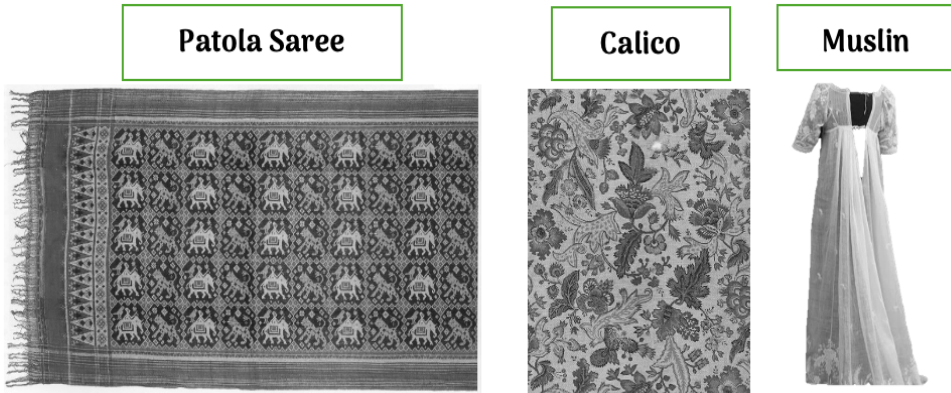
The Calico Acts (1700, 1721) banned the import of most cotton textiles into England, followed by the restriction of sale of most cotton textiles. It was a form of economic protectionism, largely in response to India (particularly Bengal), which dominated world cotton textile markets at the time. The Acts were a precursor to the Industrial Revolution, when Britain eventually surpassed India as the world's leading textile manufacturer in the 19th century.[20]

Types of Muslin

1. **Malmal – The finest one and used only for kings and nawabs.**
2. **Shabnam – It looked like a morning due.**
3. **Seerbund – used for making turbans**
4. **Abirawan – Its smoothness was compared with running water.**
5. **Buddankhas – Special sort of cloth**

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[19] www.memeraki.com

[20] www.dbpedia.org

At very early morning the virgins used to go to the middle place of the river by floating the boat for humidity. They used to take yarn by rotating their soft finger with keeping the hand vertically on the conch or turtle's egg. The world famous finest and smoothest fabric was made by using these yarns. The fabric was legendary. A 50-meterlong fabric could be squeezed and put into a matchbox. The king, emperor and the sovereign bought this cloth for their queen to get their heart and the royal women were very infatuated with this cloth. The name of the world-famous cloth is MUSLIN the great and glorious history of Bangladesh.

1875 Edward VII prince of wales visited Bengal for whom Sir Abdul Gani ordered 30 yards of muslin as a gift to the prince. One yard of it merely weighed 10 grams. Bengal cotton was exported to Roman and Chinese empires and its mentions are found in *Perilpus of Erithrean sea* and mentions of *Ptolemy geography.* This profession was familial and members of family or two or three families would weave.


https://www.metmuseum.org/art/collection/search/656930

Famous Muslin Wearers

- **Marie Antoinette, wife of king Louis XVI (France)**
- **Josephine Bonaparte, wife of Napoleon Bonaparte (France)**

- **Georgiana Cavendish, the duchess of Devonshire (England)**

Story of Indian Fabrics

Dr John Forbes Watson's work on Indian textile gives us richness of Indian fabric. It's a compendium of **18 volumes** and intended to copy Indian weaving style, texture, use of material. It was catalogued to show British manufacturers a wide variety of popular Indian fabrics so that they could be reproduced using British factories in **Lancashire** and sell in India with cheaper rates. Ironically, this 18-volume catalogue, is the only documentation for many Indian textile traditions that have since died.
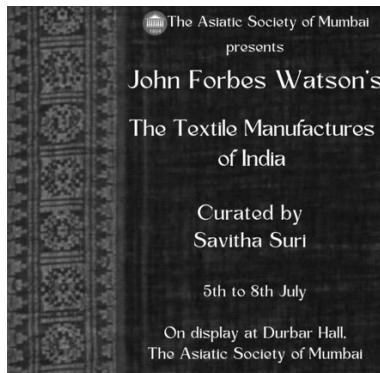
Coromandel Chintz

Chintz played very important role globally popularizing Indian art of weaving, dying and embroidery. Chintz means spotted cloth. The technique of mordant and resist painting was mastered by only Indians that time. It is floral style of decoration done by hand drawing and dyeing with mordants and resists. It was produced mainly for export and destinations were Portugal, Indonesia, China, Thailand, Japan, Srilanka, Africa and many more. Indian spinners and weavers were master craftsmen in the production of the finest cotton dating back to 3500-2000 BCE. This was one of the age-old techniques that Indian artisans had mastered which the Westerners were not aware of.

The well-perfected knowledge of mordant painting with the right combination of natural dyes enabled the dyer to produce a wide array of colours using natural materials, which were inherent to the local habitat. Various natural materials used were myrobalan, lac, madder, turmeric, and indigo, resulting in the development of a wide array of colour development, which imparted awestruck beauty with excellent light and colour fastness. The technology and precise chemistry were so advanced that modern-day science is unable to explain them. In France, it was first sought after by the aristocracy; as in England and Spain but it was not long before the working-class women also adopted the fashion, in other words wearing Chintz became the trend.

While importers of the Chintz gained massively from the movement, many merchants who still dealt in silk and wool almost rioted against the foreign fabric, ultimately leading to many governments banning the fabric. Bans - In France the fabric was fully banned between the years 1686 and 1759, in England, there was a partial ban on imports between 1700 and 1774. There were similar restrictions in Spain, Italy, and even Turkey. Even after getting banned, the demand didn't wane, the traders started smuggling the fabric into many countries. It also fuelled local industries to copy the Indian Chintz.[21]

Source:https://www.bbc.com/culture/article/20200420-the-cutesy-fabric-that-was-banned

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[21] Mitali Shah & Dr Madhu Sharan. (2023). Indian Chintz-Craft Identification as an Exquisite Hand-Painted Traditional Textile

Notes:

20.
Maritime Navigation & Shipbuilding

It is well evident that the Harappans were the first mariners of the Indian subcontinent, had trade contacts with Sumerians and Mesopotamians and followed the coastal route. The depiction of boats on seals, potsherds and terracotta affirms that the Harappans used flat bottomed and sharp upturned prow and stern type of boats. This maritime enterprise not only bolstered India's economy but also facilitated the exchange of ideas and technologies with neighbouring civilizations. Numerous archaeological findings provide insight into the vibrant maritime activities of ancient India. For instance, the excavation of the port city of Lothal in Gujarat revealed a sophisticated dockyard dating back to around 2400 BCE and maritime history is available from the Early Historical Period onwards. Similarly, the representation of various types of crafts on seals, coins, graffiti on potsherds, terracotta seals,

temple walls and rock paintings suggest that these were used for maritime trade, warfare, fishing, ferrying, etc. both in rivers, lakes and seas in different periods of history (Fig. 2). There were mainly two groups of vessels, namely river going and sea going. Each again had various types depending on dimension, capacity and height.

Indus Valley Seal, Boat with direction-finding birds to find land.

One of the notable contributions to maritime navigation was made by the ancient Indian mathematician and astronomer Aryabhata. In his work, Aryabhatiya, dated to the 5th century CE, Aryabhata described mathematical principles and astronomical observations that improved navigational accuracy. His understanding of trigonometry and celestial mechanics aided sailors in determining their position at sea using celestial bodies such as the sun and stars.

For trade of silk and cotton along with precious gems like diamonds and pearl Europe. Spices like Pepper, cinnamon and cardamom were highly sought commodities

Excavations at sites like Dwaraka and Poompuhar have revealed remnants of ancient Indian harbours and shipwrecks indicating the naval activities. During Chola period deployment of naval fleets was instrumental in securing coastal territories against foreign invaders. Historical accounts suggest that Indian naval forces were well

trained and organized with specialised units for combats.

Excavations at Pattanam (Kerala) have unearthed Roman coins, West

Asian pottery, and Chinese ceramics indicating the diversity of trade partners and cultural influences. With the rise of Islamic powers in the Middle East and Central Asia, maritime trade patterns shifted towards the Red Sea and Persian Gulf routes, bypassing traditional Indian Ocean routes.External invasion and conflicts also took a toll on India's maritime trade and naval capabilities. Arab and Turkish invasion disrupted maritime trade routes and destabilised coastal regions.

South India & Shipbuilding

Kappal Sattiram is the paper manuscript, which gives minute details about shipbuilding and navigation systems prevalent in India. It is written anonymously somewhere in medieval India. The manuscript gives details about standard measurement of ships, suitable time for ocean going vessels, recovering from wreckage etc. Interestingly, the book talks about one eyed men as a danger to ship. Exactly the same image of pirates we can see in European context.

Andhras (Satvahanas- 2nd century BCE to 3rd century CE) built their ships that were propelled by wind, which were known as Pavanbalsamahahay. Kakinada, Kalyani and Narsapuram were their main ports. The coins Sri Shatkarni, depict ships which indicate maritime prowess of India.

Construction of Ships in India

Yuktikalpataru otherwise known as Vrksayurveda (the Science of plant life), the early medieval period text of the 11th century ce compiled by the King

Bhoja of Dhar, Central India, mentions that *sea going vessels are sewn with fibres and ropes and no iron nails are used*, because there is an apprehension that submerged magnetic rocks in the sea would attract the iron nails. No iron at all is used in the construction of ships. An interesting sidelight on the use of sewn planks in these eastern waters is the widespread myth, first recorded by King Bhoja, that iron nails would be drawn out of any ship that passed near a certain magnetic mountain.

Al-Masudi (Arab Historian 10th Century) noticed that since early medieval times, sewn ships were being plied on the Indian coasts. Planks seem to have been joined by ropes and coconut fibres. Tilakamanjari mentions that the broken planks were fastened together tightly and the chief sailor's duty was to examine all joints before the ship set sail. The holes used to be caulked by wax and wool.

Odia literature, for instance the Datha Dhatu Vamsa mentions that the tooth relic was transferred from Dantapura of Kalinga to Sri Lanka in a well plank-built ship, sewn together with ropes, having a well rigged, lofty mast with a spacious sail and manned by skilful navigators.[22]

Ancient knowledge of currents

The Satapatha Brahmana, of the later Vedic period, provides some ideas about the circulation of oceanic water. The text mentions, 'The Ocean flows round this world on all sides'. Eggeling comments about turning to the right i.e.; from east to south following the course of the Sun. An examination of the above passage reveals that it refers to the southwest monsoon, which lasts from May to September. During this period the general flow of the current is from east to south.

Aryasura in the Jatakamala of 4th century CE differentiates waves from currents and terms the latter as salila. It is interesting that seafarers

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22 www. drs.nio.org

were aware that there are three physical phenomena in the ocean: i) tides ii) currents   iii) waves.

By observing fish, the colour of water, birds and rocks the mariners knew how to determine in which area of sea they were sailing. If a sailor threw a handful of sand or shell and feathers into the calm sea, the drift of the feathers on the surface and the sinking of sand or shell in the sea would provide an estimate of the speed of the current. On the basis of speed of current, sailors decided their anchorage off the coast. Many early practices are still surviving on the eastern coast of India.

Sailing seasons

The people of the east coast of India took a route along the coastline and went up to Sri Lanka. Subsequently, with the help of the equatorial current, they proceeded towards Java. Hiuen Tsang took this route for his return journey to China. The timing of the journey was also related to the route. While returning through the same route the seafarers of the east coast of India had to consider two factors:

 i)   Direction of the wind
 ii)   Movement of the water for their journey

During the period from June to September, the southwest monsoon wind blowing from southwest naturally helped a ship to return from Sri Lanka to Tamil Nadu, Andhra, Orissa and Bengal. Similarly, from November to February, the monsoon winds blowing from the northeast helped the ships to sail from the East Coast to Sri Lanka for overseas trade. Just as the Arabs had a thorough knowledge of the winds and currents of the Arabian Sea, the sailors of the East Coast of India had expert knowledge of the Bay of Bengal.

To sum up, the knowledge of sailing, wind, current, seasonal monsoons, etc. helped the mariners of India to nurture a rich maritime

heritage for centuries together.[23]

Navigation in Arthashastra

The Superintendent of Ships was called Naukadhykasha in Mauryan age. Rules mentioned by Kautilya for water navigation are:

1. Himsrika – pirate ships to be destroyed
2. Klripta – tax paid by villages on seashore
3. Yatravetana – Tax paid by passengers arriving on board the king's ship
4. Naukahataka – amount paid to hire state's ship to bring conch shells and pearls
5. Mahanaav – a boat used to cross river which does not recede during winter & summer also
6. Shaasak – a captain of the ship
7. Niyamak – a steersman

Shivaji Maharaj & his Navy

It seems that Shivaji Maharaj must have started building ships right after capturing Kalyan and Bhivandi on 24th October, 1657. Seeing the strategic and mercantile importance of this area he started building warships. Different historian hold different views on the number of ships in Shivaji Maharaj's aramada but it is certain that they were not less than 200. A Portuguese Governor General of Goa writes to his majesty stating about seize of Kalyan and Bhivandi by Shivaji Maharaj. He also expresses his concern about building warships and ports at Bhivandi and Panvel.

Kalyan was major port and shipbuilding centre having abundance of excellent timber. The maratha navy contained 5 types of ships:
i) Ghurabs – 16 guns and 150 men

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23 K.V. Ramakrishna Rao I.R.S. The Shipping Technology of Cholas

ii) Pal shibars

iii) Sangameshwari boats – fast paced small sized ships

iv) Galbats – 6 guns 60 fighters

v) Manjuahs

Daulat Khan and Mainak Bhandari were noted admirals of Maratha Navy. 1st naval expedition launched by Shivaji Maharaj was at Basrur & Bidnur, Karnataka. It was only personally led naval expedition of Shivaji Maharaj. Though this battle had no direct engagement due to diplomatic precautions of Shivaji Maharaj but it is milestone in his naval career. Realizing the difficulty of capturing Janjira, he decided to make Khanderi as his naval base. In August, 1679 during renovation project of Khanderi Marathas had engagement with Britishers for 5 months and resulted in victory of Marathas. This battle is very well known for quickness of Marathas ships in shallow water.
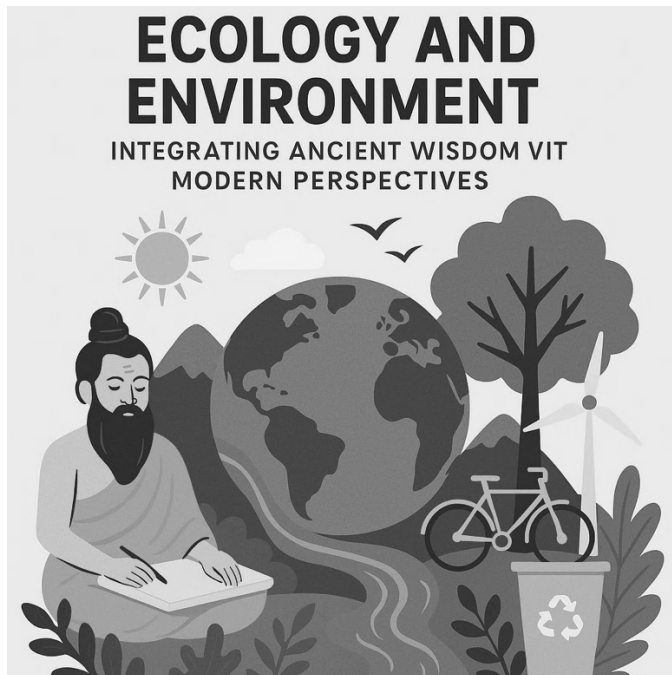

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Notes:

21.
Ecology and Environment

(Integrating Ancient Wisdom with Modern Perspectives)

Indian Knowledge Systems, or *Bharatiya Jnana Parampara*, view the natural world—not just as a resource but as a sacred web of life.

Modern environmental crises have led us back to ancient civilizational wisdom, and India's knowledge traditions provide a treasure trove of ecological insights. From the *Ṛgveda* to Atharvaveda, from folk traditions to art and each sphere of life, nature is both celebrated and protected. our

ancestors lived in harmony with the environment. The core of Indian ecological thinking lies the idea of **unity and interconnectedness**.

- **Vasudhaiva Kutumbakam** – "The whole world is one family." This worldview does not separate humans from nature.
- **Pancha Mahabhutas** – Earth (*Prithvi*), Water (*Apas*), Fire (*Agni*), Air (*Vayu*), and Space (*Akasha*) are not mere elements—they are divine, and life exists because of their balance.
- The concept of **Ṛta** (cosmic order) in the Vedas emphasizes balance in the universe. Disrupting nature disturbs this cosmic order.

Environmental protection is, therefore, not an external imposition but an inner discipline—**Dharma**.

Ancient Texts and Ecological Thought

Our scriptures embody environmental consciousness:

1. Vedas

- The *Ṛgveda* has hymns addressed to rivers, mountains, and trees.
- *Prithvi Sukta* is a poetic and reverent prayer to Mother Earth.

2. Upanishads

- Teach the philosophy of non-duality—**Advaita**—where the divine pervades all beings, including trees, animals, and rivers.

3. Smṛti Texts & Dharmaśāstra

- Prescribe penalties for cutting trees and polluting water bodies, reflecting legal consciousness of environmental ethics.

4. Itihasa & Purana

- *Ramayana* and *Mahabharata* describe forests (*vana*) not as wilderness but as places of knowledge and refuge.
- *Matsya Purana* lists kinds of trees to be planted for religious merit.

Practical Traditions & Environmental Ethics

India's ecological wisdom was not limited to texts—it was lived through traditions:

- **Sacred Groves (Devrai / Kavu):** Forests preserved in the name of local deities—no one dares to cut a tree or harm wildlife there.
- **Worship of Animals:** Cow, snake, peacock, elephant—all revered in Indian culture, symbolising coexistence.
- **Ahimsa (Non-violence):** A guiding principle not only in ethics but in ecology too—reflected in Jain, Buddhist, and Hindu traditions.
- **Water Conservation:** Stepwells (*Baodis*), tanks, temple ponds, and rainwater harvesting in ancient cities like Dholavira showcase hydraulic engineering combined with reverence.
- **Agriculture and Ayurveda:** Farming was aligned with lunar and solar cycles, promoting sustainability. Ayurveda emphasizes balance in the environment and the body—using herbs, forests, and natural methods.

Contemporary Relevance: What can we take from this today?
- Reclaiming **traditional ecological knowledge** can enhance our sustainability efforts.
- Urbanization must learn from ancient city planning—where temples, water bodies, and trees coexisted.
- **Environmental education** must include moral and cultural dimensions—creating *sattvic* attitudes toward consumption.

The Indian Knowledge System teaches us that environmental degradation is not just a physical issue—but a **spiritual imbalance**.

The Cosmological (not Anthropological) Vision in Indian Knowledge Systems

The Indian Knowledge Systems (IKS), deeply rooted in ancient Sanskrit texts and traditions, present a unique and holistic cosmological vision. Unlike the fragmented perspectives often found in contemporary scientific paradigms, IKS offers an integrated and spiritual understanding of the

cosmos, where all existence is interconnected, sacred, and purposeful. This vision forms the foundation of India's philosophical, ecological, spiritual, and even social structures.

The Universe as a Living Consciousness

In IKS, the universe (*Brahmāṇḍa*) is not merely a mechanical structure of celestial bodies, but a living, dynamic entity permeated with consciousness (*Chaitanya*). The underlying principle of creation is the universal self or *Brahman*, which manifests through various forms and phenomena. The famous declaration of the Upaniṣads, *Sarvam khalvidam Brahma*—"All this is indeed Brahman"—captures the essence of this worldview. In this sense, every element of nature, from a blade of grass to the stars in the sky, is an expression of the same divine reality.

Ṛta: The Principle of Cosmic Order

Central to the Vedic cosmology is the concept of *Ṛta*, the natural and moral order that governs the universe. It is through Ṛta that the sun rises and sets, the seasons rotate, and living beings find their rhythm of existence. Ṛta ensures that the cosmos functions in a harmonious and balanced manner. Human beings, as part of this cosmic order, are expected to align their actions with Ṛta, thereby maintaining both internal and external balance. This alignment becomes the basis of *Dharma*—one's duty in accordance with cosmic law.

Pancha Mahabhutas: The Five Great Elements

The cosmological framework in IKS identifies five fundamental elements—*Prithvi* (Earth), *Apas* (Water), *Tejas* or *Agni* (Fire), *Vayu* (Air), and *Akasha* (Space). These *Pancha Mahābhūtas* constitute all forms of matter and life, forming a bridge between the microcosm (*Pinda*) and the macrocosm (*Brahmāṇḍa*). Human beings are seen as embodiments of the universe, and hence, their well-being is inherently linked to the well-being of the

environment. This leads to an ecological ethic wherein harming nature is seen as self-destructive.

Cyclical Time and the Yugas

A significant aspect of Indian cosmology is its conception of time as cyclical (*Chakrikāla*), not linear. The vast time cycles—*Yugas* (Satya, Treta, Dvapara, and Kali), *Manvantaras*, and *Kalpas*—demonstrate a profound understanding of cosmic rhythms and evolution. This cyclical vision reflects the idea that the universe undergoes constant creation (*Sṛṣṭi*), preservation (*Sthiti*), and dissolution (*Pralaya*) in an eternal loop. The immense durations described in the Purāṇas, such as a *Kalpa* lasting 4.32 billion years, align remarkably with modern cosmological timelines.

Integration with Astronomy and Sacred Architecture

The IKS cosmological view is further reflected in Indian astronomy (*Jyotiṣa*), which observes celestial bodies not merely for calendrical purposes but as manifestations of divine order. Temples in India are designed according to precise astronomical and cosmological principles, aligning their structures with planetary positions, cardinal directions, and sacred geometry. Thus, sacred architecture becomes a physical expression of the cosmos, bridging heaven and earth.

Ethical and Ecological Implications

The cosmological vision of IKS is not purely metaphysical; it carries deep ecological and ethical implications. Since the universe is viewed as divine, all forms of life are treated with reverence. Environmental conservation is not an external obligation but an inner discipline, a *Dharma*. Rituals, festivals, and daily practices emphasize gratitude toward nature, evident in the worship of rivers, trees, mountains, animals, and the elements. The concept of *Ahimsā* (non-violence) extends beyond human interactions to include all living beings and natural elements.

The cosmological view presented by the Indian Knowledge Systems invites a harmonious coexistence of science, spirituality, and ecology. It reminds us that the universe is not a collection of lifeless matter but a vibrant, conscious order governed by eternal principles. In times of environmental crisis and spiritual disconnection, this ancient worldview offers a timeless message: that to understand the cosmos is to understand ourselves, and to live in balance with it is both our heritage and our responsibility.

Indian Knowledge Systems invite us to see nature as **sacred**, **interconnected**, and **alive**. As students of modern education, we are not only inheritors of this wisdom but also its custodians. Let us build a future where science and tradition walk hand in hand.

What would our world look like if every tree was seen as a teacher, every river as a goddess, and every mountain as a sage?

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22.

Music and Dance

The Indian Knowledge Systems (IKS), rooted in *Sanātana Dharma*, encompass a wide range of disciplines including philosophy, science, literature, art, and aesthetics. Among these, **music (*Sangīta*) and dance (*Nrtya*)** hold a revered position. These art forms are not merely for entertainment but are deeply intertwined with spirituality, education, and societal development, reflecting the holistic vision of Indian culture.

Philosophical Foundations:

In Indian tradition, music and dance are viewed as divine expressions. According to *Nāṭyaśāstra* of Bharata Muni—considered the foundational treatise of Indian performing arts—**Nāṭya (dramatic performance)** includes *Gīta (music)*, *Vādya (instrumental music)*, *Nṛtya (pure dance)*, and *Nāṭya (dramatic representation)*. Bharata describes *Nāṭya* as a fifth Veda (*Pañcama Veda*), created by Brahmā to educate and entertain all varṇas, thus making it a carrier of **dharma, artha, kāma, and mokṣa**.

Music in Indian Knowledge Systems:
1. **Origin and Development:**
   - Indian music traces its origins to the *Sāma Veda*, where hymns were chanted in melodic forms (*sāmagāna*). This laid the foundation of the **spiritual and sacred dimension of music** in India.
   - Over time, two main streams of classical music evolved: **Hindustani (North Indian)** and **Carnatic (South Indian)**, both deeply rooted in rāga (melodic framework) and tāla (rhythmic cycle).
2. **Educational Role:**
   - Music was taught in *Gurukulas* as part of a complete education that balanced intellect and emotion.
   - Ancient texts like *Dattilam*, *Brhaddeshi*, *Sangīta Ratnākara*, and *Nāradīya Śikṣā* provided scientific discussions on acoustics, scales, instruments, and voice modulation.

Music and Dance in Indian Knowledge Systems

Introduction

Indian Knowledge Systems routed In *Sandĩia)* encompass a wide range or sange drivers encompa a spirituality, education, and societal devlopment among E*dåhis yelevence*.

Philosophical Foundations

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Music in Indian Knowledge Systems

1. **Origin of Indian music** in Såma Veda.
   - Evoluton inta Indinstani in Cámatic streamš: *Nátya* (dramatic purformance) or fith Veda.
   - Over time,: two main streams of *Gurukɪɪas—* balancing intellect and emotion, texts like Datillåm. Bthåddesì, Sangita Ratnakara, and Náradiya Siksá.
2. **Spiritual Dimensions Dance** communicates rosa (aesthetic emotion). *bháva* (sentiment, conveyìng stories from Itihåsas ànd Putånas.

Dance in Indian Knowledge Systems

Sacted and Spiritual Purpose: Dance communucåling *rasa* (aesthetic emotiion) and *bhåvà* (semiment), conveying stories from Itihásas and Puránas.

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Dance in Dance as Pedagogical Tools

- Temple education conveying stories of the *Ramåyana·* and Mohabharuathough *bhåjans* an dance-dramas
- Falk music and dance (like *Lovani*, Banl, Kiītan. Blhú—*Ghovmár*) act as mediums *for* transmiizing oral traditions aɪ cultural memory

3. **Spiritual Dimensions:**

- Bhakti movements across India employed music as a powerful tool for devotional expression. Saints like Tulsidas, Meerabai, Tyagaraja, and Tukaram used music to connect with the Divine.

- The *Nāda Brahma* philosophy considers sound (*nāda*) as the source of creation, aligning music with metaphysical cosmology.

Dance in Indian Knowledge Systems:

1. **Sacred and Spiritual Purpose:**
   - Dance is seen as a form of *Yajña*—a sacred offering. The **classical dance forms** such as *Bharatanāṭyam*, *Kathak*, *Odissi*, *Mohiniyāttam*, *Kuchipudi*, *Manipuri*, *Kathakali*, and *Sattriya* are embodiments of this philosophy.
   - Each dance form is a combination of **Nāṭya (dramatic element)**, **Nṛtta (pure dance movements)**, and **Abhinaya (expressive gestures)** conveying stories from Itihāsas and Purāṇas.

2. **Epistemological Value:**
   - Dance communicates **rasa** (aesthetic emotion) and *bhāva* (sentiment), thereby contributing to emotional intelligence and ethical understanding.
   - It integrates physical agility with mental discipline and aesthetic sensitivity, reflecting the *integrated approach to knowledge* that IKS promotes.

3. **Cultural and Social Impact:**
   - Traditional performances served as vehicles of **moral education and community bonding**, especially during festivals and rituals.
   - Temples were historical centers of both music and dance, with devadāsi systems in South India preserving dance as an act of **divine service**

Music and Dance as Pedagogical Tools:

In IKS, both music and dance are not limited to the realm of art but are used

as **pedagogical instruments**:

- In **temple education**, stories of the Rāmāyaṇa and Mahābhārata were conveyed through *bhajans* and *dance-dramas*.
- Folk music and dance (like *Baul*, *Kirtan*, *Bihu*) act as mediums for transmitting **oral traditions and cultural memory**.

Music and dance in Indian Knowledge Systems exemplify the integration of aesthetics with ethics, spirituality with science, and tradition with education. These art forms are not only expressions of joy but also **gateways to inner realization, cultural continuity, and societal harmony**. As India reclaims its ancient wisdom for contemporary relevance, the revival and re-contextualization of these performing arts through research, documentation, and pedagogy is essential.

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IKS: Global Influence

The Indian Knowledge System (IKS), rooted in traditions of wisdom, science, art, and philosophy, represents a holistic worldview that seamlessly integrates the material and the spiritual. It encompasses the domains of Ayurveda, Yoga, Mathematics, Astronomy, Metallurgy, Statecraft, Ethics, Education, Arts, and Spirituality. In the modern global context, IKS is steadily emerging not merely as an ancient heritage to be preserved, but as a dynamic force with potential solutions for contemporary challenges. The global influence of IKS lies in its ability to offer sustainable, inclusive, and integrated models of life, learning, and leadership.

Historical Spread and Global Admiration

From ancient times, India's intellectual traditions have influenced

cultures far beyond its geographical boundaries. Indian numerals and the concept of zero, developed by scholars like Āryabhaṭa and Brahmagupta, laid the foundation for modern mathematics. Nalanda and Takshashila attracted scholars from across Asia, especially from China, Korea, and the Middle East. Dharmic philosophies such as Vedanta, Buddhism, and Jainism spread through both scholastic and cultural routes, impacting regions like East Asia, Southeast Asia, and Central Asia. The global reverence for Indian wisdom is evident in historical travelogues of foreign travelers like Faxian, Xuanzang, and Al-Biruni.

Contemporary Relevance and Global Acceptance

In today's era, IKS is being revisited and re-evaluated on the global stage due to the increasing need for sustainable and holistic alternatives to modern, mechanistic systems. Yoga, once a deeply meditative spiritual practice rooted in the Yoga Sutras of Patañjali, has now become a global health movement. The declaration of **International Day of Yoga** by the United Nations in 2014 is a clear testament to its worldwide acceptance.

Ayurveda, the science of life and wellness, is being increasingly integrated into global healthcare systems, particularly in wellness tourism, naturopathy, and preventive medicine. Concepts such as *Dinacharya* (daily routine), *Ritucharya* (seasonal regimen), and *Sattvic diet* are being embraced for their natural and preventive approach to health.

Similarly, Indian philosophical concepts like *Ahimsa* (non-violence), *Dharma* (righteousness), and *Sarva-dharma-sambhāva* (respect for all religions) are being viewed as foundational for global peace and intercultural harmony.

IKS and Modern Knowledge Systems

The resurgence of IKS in the realm of education and research is bridging the gap between ancient Indian insights and contemporary global needs. Indian epistemology (pramāṇa-śāstra), pedagogy (gurukula and

śāstra-śikṣā), logic (Nyāya), linguistics (Vyākaraṇa), and environmental ethics (ṛta and ṛṇas) offer valuable contributions to modern discourses in cognitive science, linguistics, artificial intelligence, and ecological studies.

Furthermore, in the age of AI and sustainability, the world is looking toward decentralized, ethical, and holistic models of development—values inherently embedded in IKS.

Global Movements Inspired by IKS

Many modern leaders and thinkers, including Mahatma Gandhi, Swami Vivekananda, and Rabindranath Tagore, carried IKS-based ideas across the world, inspiring movements in civil rights, education, and spirituality. Today, initiatives such as Indian embassies promoting Yoga and Sanskrit, international academic collaborations on IKS, and diaspora-led cultural institutions continue to serve as torchbearers of this tradition.

Challenges and the Way Forward

While the global influence of IKS is growing, it faces challenges in terms of systematic documentation, critical academic engagement, and policy integration. To truly realize its potential, India must invest in research, translation, and innovation within the IKS domain. The integration of IKS into school and university curricula, international collaborations, and support for indigenous scholars are crucial steps forward.

The Indian Knowledge System, with its rich heritage and visionary insights, holds immense relevance for a world seeking peace, sustainability, and holistic well-being. Its global influence is not merely a reflection of past glory, but a living, evolving phenomenon that can illuminate the path forward. As Bharat rises in the global arena, the revival and global dissemination of IKS can be seen as both a civilizational duty and a contribution to the global good.

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IKS & Research

(Indian Knowledge Systems and the Ethos of Research)

The Indian Knowledge Systems (IKS) are not only a treasury of wisdom but also a reflection of the deeply analytical and research-oriented temperament of ancient Indian thinkers. Far from being a collection of abstract speculations, IKS offers a highly structured, logical, and experiential framework for inquiry, innovation, and application. At its core, research within the Indian tradition is not merely about the pursuit of knowledge for its own sake, but about śreyas (the highest good) and lokasaṃgraha (the welfare of society).

Ancient Indian Traditions of Research and Inquiry

The tradition of structured thinking and argumentation in India is

foundational to many philosophical schools, scientific texts, and literary works. It is this tradition that gave rise to methodologies like *Tantrayukti*, *Pañcāvayava*, *Anumāna*, and the *Mīmāṃsā* method, all of which bear testimony to the rigorous intellectual culture of India.

1. **Tantrayukti (तन्त्रयुक्तिः)** – Literally meaning "techniques of systematisation," *Tantrayukti* refers to the methods employed for composing and interpreting *śāstra-s* (treatises). It includes a detailed framework that aid in the presentation and analysis of knowledge.

2. **Pañcāvayava (पञ्चावयवः)** – The Nyāya school elaborated the five-membered syllogism known as *pañcāvayava*:

   o *Pratijñā* (Proposition)
   o *Hetu* (Reason)
   o *Udāharaṇa* (Example)
   o *Upanaya* (Application)
   o *Nigamana* (Conclusion)

   This structure ensured not only clarity but also intellectual honesty and comprehensiveness in arguments, which is central to any research methodology.

3. **Mīmāṃsā (मीमांसा)** – As a philosophical school and a method of interpretation, *Mīmāṃsā* offers intricate rules for understanding sacred texts, analyzing linguistic contexts, and drawing consistent meanings. Its meticulous hermeneutics laid the groundwork for textual criticism and the science of meaning—both essential to research.

4. **Pramāṇa Theory (Epistemology)** – The concept of *pramāṇa* or valid sources of knowledge (like *pratyakṣa*, *anumāna*, *śabda*, *upamāna*) highlights the Indian tradition's concern with epistemic certainty. This directly mirrors the modern scientific pursuit of verifiability and reproducibility.

Relevance of Traditional Research Models for the Modern World

In the context of today's global challenges—climate crisis, mental unrest, ethical voids, and unsustainable lifestyles—the research ethos of IKS provides much-needed direction.

- **Holistic Vision**: Unlike the fragmented view often seen in contemporary research, Indian systems advocate an integrated approach—where science, philosophy, spirituality, and ethics coalesce. This *holisticity* is vital for sustainable development and policy-making rooted in *dharma* and *śrī* (well-being and prosperity).

- **Sustainable Living**: The *ṛta*-based worldview of ancient India teaches harmony with nature, cyclical time, and minimalism—values deeply embedded in texts like the *Vedas*, *Upaniṣads*, *Arthaśāstra*, and *Nāṭyaśāstra*. These ideas can inspire modern models of environmental sustainability, local economy, and community welfare.

- **Subjective and Objective Integration**: While modern science predominantly relies on objectivity, Indian research acknowledges the importance of subjective experiences (*adhyātma vidyā*)—especially in disciplines like psychology, consciousness studies, health sciences, and arts. This balance leads to inner and outer peace.

- **Research as Sādhana**: The ancient approach to knowledge was not industrial or merely professional—it was sacred. A *vidvān* was not only a scholar but a *sādhaka*, striving for *ātma-jñāna* through their work. Reviving this attitude can bring greater sincerity, humility, and ethical strength to contemporary research ecosystems.

The Way Forward

To reclaim our indigenous research frameworks and infuse them into today's academic and developmental paradigms, a few suggestions are essential:

- **Curricular Integration**: Indian research methodologies should be introduced in higher education curricula, not as alternatives but as complementaries to modern research approaches.

- **Transdisciplinary Dialogue**: Institutions must encourage dialogue

between IKS experts and scholars of modern science, social sciences, and humanities to evolve context-sensitive and culturally rooted research models.

- **Community-Centric Research**: Reviving the *gurukula* spirit where research addresses *janahita* (public good) rather than corporate gain is vital. Ancient India's knowledge was never kept secret for profit but shared freely for collective upliftment.

- **Cultural and Spiritual Anchoring**: Embedding *samskāra*, ethical inquiry, and a peace-oriented worldview within research training can help develop not just skilled professionals but enlightened citizens.

Indian Knowledge Systems demonstrate that research is not just about the discovery of facts but about the *realization of truth*, not just for intellectual satisfaction but for *universal well-being*. The foundational values of *dharma*, *satyam*, *ahimsā*, *śraddhā*, and *śānti* must guide our research endeavours if we are to build a future that is not only technologically advanced but also spiritually fulfilling and ecologically sustainable.

By reawakening this ancient ethos of inquiry, India can once again become a *viśvaguru*—guiding the world towards knowledge that liberates, heals, and unites.

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Epilogue

(Towards a Conscious Civilisation: the Soul of India)

As we come to the conclusion of this journey through the vast landscape of Indian Knowledge Systems, we are reminded that knowledge in the Indian tradition is not an end in itself, but a means to elevate consciousness, ensure collective well-being, and establish harmony between man and nature. The pages of this book have attempted to offer glimpses into a civilisation that has, for millennia, explored not only the outer world of phenomena but also the inner world of the self—with equal rigour and reverence.

What emerges from this exploration is the realisation that IKS is not a mere repository of ancient achievements, but a living tradition—dynamic, evolving, and deeply relevant to the contemporary world. Its foundational values—*Dharma*, *Satya*, *Ahimsa*, *Sādhanā*, and *Samatā*—continue to inspire pathways to sustainable development, ethical leadership, and inner resilience. The integration of knowledge and wisdom in Indian thought underscores a unique approach to life where science is not divorced from spirituality, and progress is measured not just in material terms but also in *santulan* (balance) and *ānanda* (inner joy).

In this age of environmental degradation, mental unrest, and ethical ambiguity, the Indian Knowledge Systems offer a much-needed corrective lens—rooted in ecological consciousness, holistic wellness, and spiritual purpose. From water management to yoga, from metallurgy to philosophy, from education to aesthetics, these systems speak to a civilisation that has

long understood the importance of living in alignment with both cosmic principles and human values.

The rediscovery and revival of IKS is not only an academic responsibility—it is a national and civilisational dharma. It calls upon educators, scholars, policymakers, and citizens alike to engage with this treasure trove with humility, curiosity, and commitment. The National Education Policy 2020 has laid a foundational framework for this integration, but its success depends on our collective will to nurture *Bharatiya Jñāna Paramparā* not as a relic, but as a renaissance.

Let us remember: the strength of a nation lies not only in its economy or military but in the vitality of its culture, the depth of its wisdom, and the clarity of its vision. By reclaiming the essence of Indian Knowledge Systems, we are not turning back to the past—we are stepping forward with purpose, rooted in our timeless ideals, and guided by the spirit of *Vasudhaiva Kuṭumbakam*.

As inheritors of this profound tradition, may we continue to study, practice, and disseminate this knowledge with reverence and responsibility— so that India may not only rise as a *viśvaguru* in thought but also serve as a compassionate leader in shaping a more harmonious, sustainable, and enlightened world.

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Testimonial

There is a lot of practical goodness in the project *Indian Knowledge Systems (IKS)* initiated by my colleague Dr Sandeep Dhikale and his scholarly team. By goodness, I do not mean spiritual aims achievable, as one of my teachers once put it, by an elite only, but rather a form of knowledge that addresses the immediate concerns a person faces daily: building character for mental and emotional resilience amidst an intricate and often chaotic post-modern world.

One of the shortcomings of worldwide schooling today is the emphasis on information and its separation from knowledge. The result of such a split is twofold: 1) not only a professional deformation displayed by highly literate scholars – namely, an incapacity to see the wood for the trees – but 2) more importantly, a severance between scholarship and character. *Indian Knowledge Systems* aims to heal this gap.

Through a set of linguistic and general knowledge skills, all interwoven harmoniously, IKS aims to teach students to think outside the box and to apply knowledge for the betterment of the individual human being as well as of the broader community. Good knowledge makes good people, and good people make a better world.

As a Western scholar, I wish to endorse this project, and at the same time hope that, in an increasingly divided world, it will teach students that knowledge is not self-sufficient, but conversant, dynamic, and ethically motivated, always moving towards the highest good.

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Indian Knowledge Systems

(A treasure trove of the way of Holistic and Sustainable Life)

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Sri. Sandeep Jadhav is an amalgamation of modern and traditional education systems. Having studied Philosophy, Sanskrit in the Gurukul, Sandeep completed his masters in three subjects – History, Indology and English. His expertise in IKS extends from Management Studies, mathematics and architecture to astronomy, technology and linguistics. Qualified UGC NET in IKS twice, he is currently working with reputed Universities like MIT-WPU, Indira University and DY Patil University.

He is a founder of the 'Yajñayoga Foundation', an organisation serving Nature, Culture and Wellness.

Qualifications
VINIT (Gurukul System)
M.A. (Indology)
M.A. (History)
M.A. (English)
UGC - NET (IKS) (Twice)

Dr. Sandeep Namdev Dhikale (Sandeepsagar)
(Sanskritist, Peacebuilding Activist, Indologist)

Dr. Sandeep Dhikale, also known as Sandeepsagar, embodies a distinctive confluence of the traditional Gurukul system and modern educational paradigms. His academic pursuits span a spectrum of disciplines, including Sanskrit, Peace Studies, Indology, and Meditation. Dr. Sandeep has actively contributed to academia by presenting over 22 research papers at various international, national, and state-level conferences, reflecting his interdisciplinary approach and commitment to scholarly excellence. He is also the author of three acclaimed books: 'Understanding Peace'; 'Dimensions of Peace'; 'Indian Knowledge Systems: A Treasure Trove of the Way of Holistic and Sustainable Life' These works reflect his deep engagement with the themes of peace, holistic living, and the rich heritage of Indian knowledge traditions. He is currently serving as an Assistant Professor in Peace Studies at the School of Business and Management, MIT World Peace University, Pune.

Qualifications:
- Ph.D. (Sanskrit) (Deccan College, Pune)
- VINIT (Philosophy and Sanskrit) (Tattwajnyan Vidyapeeth, Thane)
- N.E.T. (Sanskrit) (UGC)
- N.E.T. (Hindu Studies) (UGC)
- M.Phil. (Sanskrit) (Deccan College, Pune)
- M.A. (Sanskrit) (S.P. Pune University, Pune)
- B.A. (Sanskrit) (Tilak Maharashtra Vidyapeeth, Pune)
- Veda Nipun (Maharshi Sandipani Rashtriya Vedavidya Pratishthan, Ujjain)
- Diploma in Prakrit and Jainology, (Bahubali Prakrit Vidyapeetha, Karnataka)
- Jain Visharad (Tilok Ratna, Anandadham, Ahamadnagar, MH)
- Indian Knowledge Systems, Central Sanskrit University
- Philosophy, Science and Religion (Edinburg University, UK)
- Science of Well-Being (Yale University, USA)

'Learning IKS through translations bypassing Sanskrit can only produce CHEERLEADERS, not true CONTRIBUTORS to IKS-based innovation.'

'The best candidates for training are those from STEM careers, as they already have the scientific nerve to appreciate the sophistication of Indic thought. The best trainers are shaastra scholars who teach STEM students as they get stimulated with thought-provoking questions.'

<div align="right">

– **Prof. Sai Susarla**
Executive Director,
Siddhanta Knowledge Foundation, Chennai, INDIA

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'Indian Knowledge Systems' is a timely and thoughtful contribution that bridges the ancient and the contemporary with scholarly precision. The author's deep-rooted understanding of Sanskrit texts and Indian philosophical traditions shines through every chapter. It is a commendable effort that invites readers worldwide to engage with India's intellectual legacy in a meaningful way.

<div align="right">

– **Prof. Julia Walker** (USA)

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This book is an illuminating exploration of India's vast knowledge traditions, beautifully articulated through the lens of Sanskrit scholarship. A must-read for anyone interested in understanding the depth and relevance of Bharatiya Jnana Parampara.
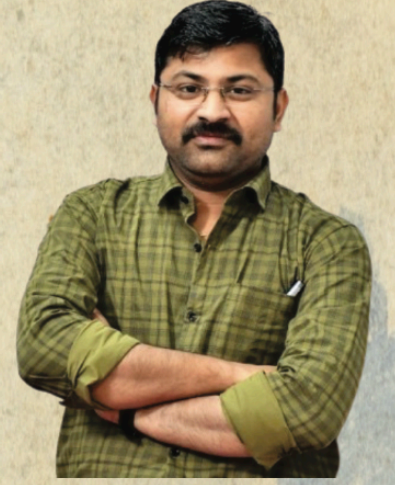
<div align="right">

– **Nguyen Quang**
(Researcher in Indic Studies, Vietnam)

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Sandeep Jadhav

VINIT (Gurukul Education)
UGC NET (IKS)

Sandeep Jadhav, having a background in History and Indology, is the amalgamation of modern thoughts and Indian Perspective. Having studied in the Gurukul system, Sandeep completed his master's in 3 subjects. His specialisation in IKS extends from Management Studies, Mathematics, and Architecture to Astronomy, technology and linguistics. Having qualified UGC NET in IKS twice, he is currently working as a visiting faculty with reputed universities like MIT-WPU, Indira University and D.Y. Patil University.

Dr. Sandeep Dhikale, (also known as Sandeepsagar), embodies a unique blend of traditional Gurukul and modern educational principles. Currently, he is searving as an Assistant Professor of Peace Studies, at SoB, MIT World Peace University, Pune.

His academic interests span diverse fields including Sanskrit, Peace Studies, IKS, Indology, and Meditation. Dr. Sandeep has presented over 22 research papers at international, national, and state-level conferences.

Dr. Sandeep Dhikale

PhD Sanskrit & Lexicography
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